EUROPEAN COMMISSION

7th Framework Programme for
Research, technological
Development and Demonstration

Marie Curie Actions - IRSES

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Participant	*PIC*
POLITECHNIKA SLASKA	999899087
UNIVERSITY OF STRATHCLYDE	999974068
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Institute of Problems of Chemical Physics, Russian Academy of Sciences	957682359
LVIV POLYTECHNIC NATIONAL UNIVERSITY	998579305
University of Wollongong	998216913
GEORGIA TECH RESEARCH CORPORATION	997348860

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A1: Summary

Proposal Number	612670	Proposal Acronym	AmbiPOD

General Information

Proposal Title	Multicoloured ambipolar conducting polymers for single polymer optoelectronic devices		
Marie Curie Action Code	IRSES	Scientific Panel	CHE
Duration in months	48	Call (part) Identifier	FP7-PEOPLE-2013-IRSES

Abstract (max. 2000 chars)

The project aims at conscious development of novel conjugated polymers featuring multielectrochromic properties that can find application in polymer electrochromic or electroluminescent devices. Our aim is to obtain new π – conjugated polymers, containing both electron-donor and electron-accepting units by first selecting their monomeric precursors using quantum chemistry tools. Following synthesis, electrochemical phenomena and changes in spectroscopic properties taking place during their redox charging, will be elucidated. These materials will combine interesting spectroelectrochemical properties with tuneable electronic conductivity and for this reason they can be applied in organic optoelectronic and in electrochromic devices. Detailed identification and understanding of their redox processes will allow developing ways to tailor their physicochemical properties. Our goal is to find, synthesise, characterise and device-test these oligomeric or polymeric materials which should be easily both “p” and “n” doped. Such materials will feature low electron band gap and hence should exhibit strong electromagnetic absorption in the visible region manifesting colour. Such materials should be applicable as both as hole and electron transporting layers, effectively simplifying the construction of electroluminescent devices. This is our key scientific goal. The second one would be to investigate the possibilities of tuning the energy of emitted light taking advantage of different redox states our envisioned polymers should exhibit. The complementary advantage of these materials should be the low threshold voltage for light electrogeneration, which would decrease the operating voltage of electroluminescent devices. Joint implementation of the proposed project will allow each partner to explore new fields related to his area of scientific interest giving one of a kind opportunity to find reliable and proven partners for future scientific collaboration.

Free keywords

Conducting polymers; Quantum chemistry; Organic synthesis; Physical Chemistry; Device fabrication; Optoelectronics; Electrochromism; Electroluminescence.

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Has a similar proposal been submitted to a Marie Curie Action under this or previous RTD Framework Programmes? (●) Yes ( ) No

Programme name(s) and year	Proposal Number(s)
Marie Curie Initial Training Networks (ITN) call: FP7-PEOPLE-2013-ITN	SEP-210072507

Does this proposal include any of the sensitive ethical issues detailed in the Research Ethical Issues table of Part B? (●) Yes ( ) No

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A2.1 Participant #1

POLITECHNIKA SLASKA

If your organisation has already registered for FP7, enter your Participant Identity Code	999899087
Legal Name	POLITECHNIKA SLASKA
Organisation short name	POLITECHNIKA SLASKA

Administrative data (legal address)

Street name	Ul. Akademicka	Number	2A
Town	GLIWICE		
Postal Code / Cedex	44-100		
Country	PL		
Internet homepage	www.polsl.pl		

Status of your organisation

Certain types of organisations benefit from special conditions under the FP7 participant rules. The Commission also collects data for statistical purposes. The guidance notes will help you complete this section. Please 'tick' the relevant box(es) if your organisation falls into one ore more of the following categories.

Non-profit organisation	(•) Yes	( ) No
Public body	(•) Yes	( ) No
Research organisation	(•) Yes	( ) No
Higher or secondary education establishment	(•) Yes	( ) No
International organisation	( ) Yes	(•) No
International organisation of European Interest	( ) Yes	(•) No
Joint Research Center of the European Commission	( ) Yes	( ) No
Entities composed of one or more legal entities [European Economic Interest Group / Joint Research Unit (Unité mixte de recherché) / Enterprise Groupings]	( ) Yes	( ) No
Commercial Enterprise	( ) Yes	( ) No

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Main area of activity (NACE code)	80.3

1. Is your number of employees smaller than 250? (full time equivalent)	○ Yes	○ No
2. Is your annual turnover smaller than € 50 million?	○ Yes	○ No
3. Is your annual balance sheet total smaller than € 43 million?	○ Yes	○ No
4. Are you an autonomous legal entity?	○ Yes	○ No

You are NOT an SME if your answer to question 1 is "NO" and/or your answer to both questions 2 and 3 is "NO". In all other cases, you might conform to the Commission's definition of an SME.

Please check the additional conditions given in the guidance notes to the forms.

Following this check, do you conform to the Commission's definition of an SME?	○ Yes	◉ No

Dependencies with (an)other participant(s)

Are there dependencies between your organisation and (an)other participant(s) in this proposal?	○ Yes	◉ No

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Contact points for participant #1

Person in charge
For the co-ordinator (Participant #1) this person is the one who the Commission will contact in the first instance.

Family name*	Domagala	First name(s)*	Wojciech
Title	Dr.		◉ Male ○ Female
Position in the organisation	Research fellow		
Department/Faculty/Institute/Laboratory name/...	Faculty of Chemistry, Department of Physical Chemistry and Technology		

Address ☐ Same as legal address

Street name	ks. Marcina Strzody	Number	9
Town	Gliwice	Postal Code/Cedex	PL -44-100
Country	PL		

Phone1*	+ 48	322371305	Phone2	+ 48	322371305
Fax	+ 48	322371925	E-mail*	wojtek.domagala@polsl.pl	

** Contact details can only be changed by the Proposal Coordinator via the "Step 4 – Manage Your Related Parties" screen.*

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A2.2 Participant #2

UNIVERSITY OF STRATHCLYDE

If your organisation has already registered for FP7, enter your Participant Identity Code	999974068
Legal Name	UNIVERSITY OF STRATHCLYDE
Organisation short name	UNIVERSITY OF STRATHCLYDE

Administrative data (legal address)

Street name	Richmond Street	Number	16
Town	GLASGOW		
Postal Code / Cedex	G1 1XQ		
Country	UK		
Internet homepage	www.strath.ac.uk		

Status of your organisation

Certain types of organisations benefit from special conditions under the FP7 participant rules. The Commission also collects data for statistical purposes. The guidance notes will help you complete this section. Please 'tick' the relevant box(es) if your organisation falls into one ore more of the following categories.

Non-profit organisation	(•) Yes	( ) No
Public body	( ) Yes	(•) No
Research organisation	(•) Yes	( ) No
Higher or secondary education establishment	(•) Yes	( ) No
International organisation	( ) Yes	(•) No
International organisation of European Interest	( ) Yes	(•) No
Joint Research Center of the European Commission	( ) Yes	( ) No
Entities composed of one or more legal entities [European Economic Interest Group / Joint Research Unit (Unité mixte de recherché) / Enterprise Groupings]	( ) Yes	( ) No
Commercial Enterprise	( ) Yes	( ) No

EUROPEAN COMMISSION
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Main area of activity (NACE code) -

1. Is your number of employees smaller than 250? (full time equivalent) ○ Yes ○ No

2. Is your annual turnover smaller than € 50 million? ○ Yes ○ No

3. Is your annual balance sheet total smaller than € 43 million? ○ Yes ○ No

4. Are you an autonomous legal entity? ○ Yes ○ No

You are NOT an SME if your answer to question 1 is "NO" and/or your answer to both questions 2 and 3 is "NO". In all other cases, you might conform to the Commission's definition of an SME.

Please check the additional conditions given in the guidance notes to the forms.

Following this check, do you conform to the Commission's definition of an SME? ○ Yes ◉ No

Dependencies with (an)other participant(s)

Are there dependencies between your organisation and (an)other participant(s) in this proposal? ○ Yes ◉ No

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Contact points for participant #2

Person in charge
For the co-ordinator (Participant #1) this person is the one who the Commission will contact in the first instance.

Family name*	Anto Regis	First name(s)*	Inigo
Title	Dr.		◉ Male ○ Female
Position in the organisation	Research Associate		
Department/Faculty/Institute/Laboratory name/...	Pure and Applied Chemistry		

Address ☐ Same as legal address

Street name	Cathedral Street	Number	295
Town	Glasgow	Postal Code/Cedex	G1 1XL
Country	UK		

Phone1*	+		Phone2	+	
Fax	+		E-mail*	anto.inigo@strath.ac.uk	

** Contact details can only be changed by the Proposal Coordinator via the "Step 4 – Manage Your Related Parties" screen.*

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A2.3 Participant #3

KTU

If your organisation has already registered for FP7, enter your Participant Identity Code	999844961
Legal Name	KAUNO TECHNOLOGIJOS UNIVERSITETAS
Organisation short name	KTU

Administrative data (legal address)

Street name	K DONELAICIO	Number	73
Town	KAUNAS		
Postal Code / Cedex	44029		
Country	LT		
Internet homepage	www.ktu.lt		

Status of your organisation

Certain types of organisations benefit from special conditions under the FP7 participant rules. The Commission also collects data for statistical purposes. The guidance notes will help you complete this section. Please 'tick' the relevant box(es) if your organisation falls into one ore more of the following categories.

Non-profit organisation	(•) Yes	( ) No
Public body	(•) Yes	( ) No
Research organisation	(•) Yes	( ) No
Higher or secondary education establishment	(•) Yes	( ) No
International organisation	( ) Yes	(•) No
International organisation of European Interest	( ) Yes	(•) No
Joint Research Center of the European Commission	( ) Yes	(•) No
Entities composed of one or more legal entities [European Economic Interest Group / Joint Research Unit (Unité mixte de recherché) / Enterprise Groupings]	( ) Yes	(•) No
Commercial Enterprise	( ) Yes	(•) No

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Main area of activity (NACE code)	80.3

1. Is your number of employees smaller than 250? (full time equivalent)	○ Yes	◉ No
2. Is your annual turnover smaller than € 50 million?	○ Yes	◉ No
3. Is your annual balance sheet total smaller than € 43 million?	○ Yes	◉ No
4. Are you an autonomous legal entity?	○ Yes	◉ No

You are NOT an SME if your answer to question 1 is "NO" and/or your answer to both questions 2 and 3 is "NO". In all other cases, you might conform to the Commission's definition of an SME.

Please check the additional conditions given in the guidance notes to the forms.

Following this check, do you conform to the Commission's definition of an SME?	○ Yes	◉ No

Dependencies with (an)other participant(s)

Are there dependencies between your organisation and (an)other participant(s) in this proposal?	○ Yes	◉ No

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Contact points for participant #3

Person in charge
For the co-ordinator (Participant #1) this person is the one who the Commission will contact in the first instance.

Family name*	Grazulevicius	First name(s)*	Juozas
Title	Prof.		◉ Male ○ Female
Position in the organisation	Professor		
Department/Faculty/Institute/Laboratory name/...	Department of Organic Technology		

Address ☐ Same as legal address

Street name	Radvilenu Plentas	Number	19
Town	Kaunas	Postal Code/Cedex	LT-50254
Country	LT		

Phone1*	+ 370	37300193	Phone2	+	
Fax	+ 370	37300152	E-mail*	juozas.grazulevicius@ktu.lt	

** Contact details can only be changed by the Proposal Coordinator via the "Step 4 – Manage Your Related Parties" screen.*

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A2.4 Participant #4

IPCP RAS

If your organisation has already registered for FP7, enter your Participant Identity Code	957682359
Legal Name	Institute of Problems of Chemical Physics, Russian Academy of Sciences
Organisation short name	IPCP RAS

Administrative data (legal address)

Street name	Academic Semenov	Number	1
Town	Chernogolovka		
Postal Code / Cedex	142432		
Country	RU		
Internet homepage	http://www.icp.ac.ru/		

Status of your organisation

Certain types of organisations benefit from special conditions under the FP7 participant rules. The Commission also collects data for statistical purposes. The guidance notes will help you complete this section. Please 'tick' the relevant box(es) if your organisation falls into one ore more of the following categories.

Non-profit organisation	(•) Yes	( ) No
Public body	( ) Yes	(•) No
Research organisation	(•) Yes	( ) No
Higher or secondary education establishment	( ) Yes	(•) No
International organisation	( ) Yes	(•) No
International organisation of European Interest	( ) Yes	(•) No
Joint Research Center of the European Commission	( ) Yes	( ) No
Entities composed of one or more legal entities [European Economic Interest Group / Joint Research Unit (Unité mixte de recherché) / Enterprise Groupings]	( ) Yes	( ) No
Commercial Enterprise	( ) Yes	( ) No

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Main area of activity (NACE code)	73.1

1. Is your number of employees smaller than 250? (full time equivalent)	○ Yes	◉ No
2. Is your annual turnover smaller than € 50 million?	○ Yes	◉ No
3. Is your annual balance sheet total smaller than € 43 million?	○ Yes	◉ No
4. Are you an autonomous legal entity?	◉ Yes	○ No

You are NOT an SME if your answer to question 1 is "NO" and/or your answer to both questions 2 and 3 is "NO". In all other cases, you might conform to the Commission's definition of an SME.

Please check the additional conditions given in the guidance notes to the forms.

Following this check, do you conform to the Commission's definition of an SME?	○ Yes	○ No

Dependencies with (an)other participant(s)

Are there dependencies between your organisation and (an)other participant(s) in this proposal?	○ Yes	◉ No

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Contact points for participant #4

Person in charge
For the co-ordinator (Participant #1) this person is the one who the Commission will contact in the first instance.

Family name*	Krinichnyi	First name(s)*	Victor
Title	Dr.		◉ Male ○ Female
Position in the organisation	Leading Scientist		
Department/Faculty/Institute/Laboratory name/...	Department of Kinetics and Catalysis/Laboratory for ESR-spectroscopy of		

Address ☒ Same as legal address

Street name	Academic Semenov	Number	1
Town	Chernogolovka	Postal Code/Cedex	142432
Country	RU		

Phone1*	+			Phone2	+ 7496 5221037
Fax	+ 7496	5225636		E-mail*	kivirus@gmail.com

** Contact details can only be changed by the Proposal Coordinator via the "Step 4 – Manage Your Related Parties" screen.*

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A2.5 Participant #5

LPU

If your organisation has already registered for FP7, enter your Participant Identity Code	998579305
Legal Name	LVIV POLYTECHNIC NATIONAL UNIVERSITY
Organisation short name	LPU

Administrative data (legal address)

Street name	St. Bandery	Number	12
Town	Lviv		
Postal Code / Cedex	79013		
Country	UA		
Internet homepage	www.lp.edu.ua		

Status of your organisation

Certain types of organisations benefit from special conditions under the FP7 participant rules. The Commission also collects data for statistical purposes. The guidance notes will help you complete this section. Please 'tick' the relevant box(es) if your organisation falls into one ore more of the following categories.

Non-profit organisation	(•) Yes	( ) No
Public body	(•) Yes	( ) No
Research organisation	(•) Yes	( ) No
Higher or secondary education establishment	(•) Yes	( ) No
International organisation	( ) Yes	(•) No
International organisation of European Interest	( ) Yes	(•) No
Joint Research Center of the European Commission	( ) Yes	(•) No
Entities composed of one or more legal entities [European Economic Interest Group / Joint Research Unit (Unité mixte de recherché) / Enterprise Groupings]	( ) Yes	(•) No
Commercial Enterprise	( ) Yes	(•) No

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Main area of activity (NACE code)	Higher education

1. Is your number of employees smaller than 250? (full time equivalent)	○ Yes	◉ No
2. Is your annual turnover smaller than € 50 million?	○ Yes	◉ No
3. Is your annual balance sheet total smaller than € 43 million?	○ Yes	◉ No
4. Are you an autonomous legal entity?	◉ Yes	○ No

You are NOT an SME if your answer to question 1 is "NO" and/or your answer to both questions 2 and 3 is "NO". In all other cases, you might conform to the Commission's definition of an SME.

Please check the additional conditions given in the guidance notes to the forms.

Following this check, do you conform to the Commission's definition of an SME?	○ Yes	◉ No

Dependencies with (an)other participant(s)

Are there dependencies between your organisation and (an)other participant(s) in this proposal?	○ Yes	◉ No

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Contact points for participant #5

Person in charge
For the co-ordinator (Participant #1) this person is the one who the Commission will contact in the first instance.

Family name*	Stakhira	First name(s)*	Pavlo
Title	Prof.	◉ Male	○ Female
Position in the organisation	Professor		
Department/Faculty/Institute/Laboratory name/...	Electronic Devices		

Address ☒ Same as legal address

Street name	St. Bandery	Number	12
Town	Lviv	Postal Code/Cedex	79013
Country	UA		

Phone1*	+		Phone2	+	
Fax	+		E-mail*	stakhira@polynet.lviv.ua	

** Contact details can only be changed by the Proposal Coordinator via the "Step 4 – Manage Your Related Parties" screen.*

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A2.6 Participant #6

UOW

If your organisation has already registered for FP7, enter your Participant Identity Code	998216913
Legal Name	University of Wollongong
Organisation short name	UOW

Administrative data (legal address)

Street name	Northfields Ave	Number	1
Town	Wollongong		
Postal Code / Cedex	NSW 2522		
Country	AU		
Internet homepage	http://www.uow.edu.au/science/eesc/		

Status of your organisation

Certain types of organisations benefit from special conditions under the FP7 participant rules. The Commission also collects data for statistical purposes. The guidance notes will help you complete this section. Please 'tick' the relevant box(es) if your organisation falls into one ore more of the following categories.

Non-profit organisation	(•) Yes	( ) No
Public body	(•) Yes	( ) No
Research organisation	( ) Yes	( ) No
Higher or secondary education establishment	(•) Yes	( ) No
International organisation	( ) Yes	( ) No
International organisation of European Interest	( ) Yes	( ) No
Joint Research Center of the European Commission	( ) Yes	( ) No
Entities composed of one or more legal entities [European Economic Interest Group / Joint Research Unit (Unité mixte de recherché) / Enterprise Groupings]	( ) Yes	( ) No
Commercial Enterprise	( ) Yes	( ) No

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Main area of activity (NACE code): 80.3

1. Is your number of employees smaller than 250? (full time equivalent) ○ Yes ○ No

2. Is your annual turnover smaller than € 50 million? ○ Yes ○ No

3. Is your annual balance sheet total smaller than € 43 million? ○ Yes ○ No

4. Are you an autonomous legal entity? ○ Yes ○ No

You are NOT an SME if your answer to question 1 is "NO" and/or your answer to both questions 2 and 3 is "NO". In all other cases, you might conform to the Commission's definition of an SME.

Please check the additional conditions given in the guidance notes to the forms.

Following this check, do you conform to the Commission's definition of an SME? ○ Yes ○ No

Dependencies with (an)other participant(s)

Are there dependencies between your organisation and (an)other participant(s) in this proposal? ○ Yes ◉ No

EUROPEAN COMMISSION
7th Framework Programme for Research, technological Development and Demonstration

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Contact points for participant #6

Person in charge
For the co-ordinator (Participant #1) this person is the one who the Commission will contact in the first instance.

Family name*	Wagner	First name(s)*	Pawel
Title	Dr.	◉ Male	○ Female
Position in the organisation	Senior Research Fellow		
Department/Faculty/Institute/Laboratory name/...	Intelligent Polymer Research Institute		

Address ☒ Same as legal address

Street name	Northfields Ave	Number	1
Town	Wollongong	Postal Code/Cedex	NSW 2522
Country	AU		

Phone1*	+			Phone2	+ 61 242981445
Fax	+ 61	242273144		E-mail*	pawel@uow.edu.au

** Contact details can only be changed by the Proposal Coordinator via the "Step 4 – Manage Your Related Parties" screen.*

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A2.7 Participant #7

GTRC

If your organisation has already registered for FP7, enter your Participant Identity Code	997348860
Legal Name	GEORGIA TECH RESEARCH CORPORATION
Organisation short name	GTRC

Administrative data (legal address)

Street name	GEORGIA INSTITUTE OF TECHNOLOGY	Number	
Town	ATLANTA GA		
Postal Code / Cedex	30332 0420		
Country	US		
Internet homepage	www.gtrc.gatech.edu		

Status of your organisation

Certain types of organisations benefit from special conditions under the FP7 participant rules. The Commission also collects data for statistical purposes. The guidance notes will help you complete this section. Please 'tick' the relevant box(es) if your organisation falls into one ore more of the following categories.

Non-profit organisation	(•) Yes	( ) No
Public body	( ) Yes	(•) No
Research organisation	(•) Yes	( ) No
Higher or secondary education establishment	( ) Yes	(•) No
International organisation	( ) Yes	(•) No
International organisation of European Interest	( ) Yes	(•) No
Joint Research Center of the European Commission	( ) Yes	( ) No
Entities composed of one or more legal entities [European Economic Interest Group / Joint Research Unit (Unité mixte de recherché) / Enterprise Groupings]	( ) Yes	( ) No
Commercial Enterprise	( ) Yes	( ) No

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Main area of activity (NACE code)	80.3

1. Is your number of employees smaller than 250? (full time equivalent)	(•) Yes	( ) No
2. Is your annual turnover smaller than € 50 million?	(•) Yes	( ) No
3. Is your annual balance sheet total smaller than € 43 million?	(•) Yes	( ) No
4. Are you an autonomous legal entity?	(•) Yes	( ) No

You are NOT an SME if your answer to question 1 is "NO" and/or your answer to both questions 2 and 3 is "NO". In all other cases, you might conform to the Commission's definition of an SME.

Please check the additional conditions given in the guidance notes to the forms.

Following this check, do you conform to the Commission's definition of an SME?	( ) Yes	(•) No

Dependencies with (an)other participant(s)

Are there dependencies between your organisation and (an)other participant(s) in this proposal?	( ) Yes	(•) No

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Contact points for participant #7

Person in charge
For the co-ordinator (Participant #1) this person is the one who the Commission will contact in the first instance.

Family name*	Bredas	First name(s)*	Jean-Luc
Title	Dr.		(•) Male ( ) Female
Position in the organisation	Regents' Professor		
Department/Faculty/Institute/Laboratory name/...	School of Chemistry and Biochemistry		

Address [ ] Same as legal address

Street name	901 Atlantic Dr. NW	Number	
Town	Atlanta	Postal Code/Cedex	30332
Country	US		

Phone1*	+ 1	4043854986	Phone2	+ 404	3854986
Fax	+ 1	4048947452	E-mail*	jean-luc.bredas@chemistry.gatech.edu	

** Contact details can only be changed by the Proposal Coordinator via the "Step 4 – Manage Your Related Parties" screen.*

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A4: Funding Request

Participant Nr.	Short Name	Country	Staff to be exchanged	Monthly exchange allowance	Sub Total 1	Staff to be exchanged	Monthly exchange allowane	Sub Total 2	Requested EU Contribution
1	POLITECHNIKA SLASK	PL	37	1 900	70 300	42	2 100	88 200	158 500
2	UNIVERSITY OF STRA	UK	17	1 900	32 300	32	2 100	67 200	99 500
3	KTU	LT	20	1 900	38 000	1	2 100	2 100	40 100
4	IPCP RAS	RU	74	1 900	140 600				140 600
5	LPU	UA	70	1 900	133 000				133 000
6	UOW	AU				0	2 100	0	0
7	GTRC	US				0	2 100	0	0
Total			218		414 200	75		157 500	571 700

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PEOPLE
MARIE CURIE ACTIONS

International Research Staff Exchange Scheme

Call: FP7-PEOPLE-2013-IRSES

PART B

"AmbiPOD"

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B 5 Ethics Issues

B 1 Quality of the Exchange Programme

B 1.1 Objective and relevance of the joint exchange programme

With the advent and development of molecular systems with fine-tuned colours for non-emissive electrochromic devices (e.g., smart windows, e-papers), and light-harvesting organic materials for solar cell applications, a number of challenges still remain to be overcome. Over the years, the concept of "spectral engineering" (tailoring the complex interplay between molecular physics and the various optical phenomena occurring across the electromagnetic spectrum) has become increasingly relevant in the field of π-conjugated organic polymers. Within the spectral engineering toolbox, the "donor-acceptor" approach uses alternating electron-rich and electron-deficient moieties along a π-conjugated backbone. This approach has proved especially valuable in the synthesis of dual-band and broadly absorbing chromophores in the UV-Vis-NIR range with useful photovoltaic and electrochromic properties. The interest and demand for this type of materials grows intensively due to the development of organic electronics, also known as flexible. Polymer materials successfully compete with their inorganic equivalents, challenging them in terms of diversity, selection and optimization capabilities of the electronic structure and what is important for commercial applications, the production cost. One important application in this area are non-emissive electrochromic systems capable of reversible colour change under the influence of the applied potential. Such systems in combination with a white light source allows for the construction of polymer displays, which are considerably less power consuming than rival technologies, such as CRT, Plasma and Liquid Crystal. Another widely pursued concept is a polymer electroluminescent display, in which the applied potential results in radiant recombination of charge carriers generated, leading to the emission of visible light. In these applications, steadily developing their commercial market share, donor-acceptor type polymers may prove to be a key component owing to their synthetically tuneable colour, favourable (low power demand) redox characteristics and most importantly competitive unit manufacturing costs.

The project aims at conscious development of novel conjugated polymers featuring multielectrochromic properties that can find application in polymer electrochromic or electroluminescent devices. The scientific problem undertaken, is to obtain new π – conjugated polymers, containing both electron-donor and electron-accepting units. The electrochemical phenomena and reaction mechanisms responsible for changes of their spectroscopic properties as a result of their redox reactions, will be elucidated. These materials combine interesting spectroelectrochemical properties with tuneable electronic conductivity and for this reason they can be applied in organic optoelectronics and in electrochromic devices, offering an attractive alternative to traditional crystalline inorganic semiconductors. The object of research will be polymers obtained by electropolymerization or chemical polymerisation of monomers composed of both donor units and acceptor ones. Detailed identification and understanding of their redox processes will allow developing ways to tailor their physicochemical properties. Our goal is to find, synthesise, characterise and application test new oligomeric or polymeric materials which can be easily both "p" and "n" doped. In a sense we seek materials with low oxidation potentials and high electron affinities. The implications of these properties go beyond simple electronic structure. Such materials will feature low electron band gap and hence should exhibit strong electromagnetic absorption in the visible region. This translates to eye visible colour whose gamut could be broad and what is more, open to tailoring by modification of the molecular structure. Low band gap should also translate to the possibility of applying the very same material both as hole and electron transporting layers effectively simplifying the construction of electroluminescent devices. In such case the polymer would be the only one active layer where both holes and electrons could be injected and made to radiatively recombine to generate light emission. This is our key scientific goal. The second one would be to investigate the possibilities of tuning the energy of emitted light taking advantage of different redox states our envisioned polymers could exhibit. The complementary advantage of such materials should also be the low threshold voltage for light electrogeneration, which would translate to a decrease in the operating voltage of electroluminescent devices fabricated of this active material. The task is scientifically challenging, the project partners currently pursue its individual topics hence their gathering under a single project banner will be beneficial to all. Joint implementation of the proposed project will allow each partner to explore new fields related to his area of scientific interest giving one of a kind opportunity and find reliable and proven partners for future scientific collaboration.

To address the issues outlined above, a coordinated research effort of quantum-mechanical, synthetic, physicochemical characterisation and test device fabrication research teams is proposed in the project to ensure the best scientific approach to deliver a comprehensive solution to the problem being put forward. We propose to bring together a multi-national group of 7 renowned scientific institutions from Europe, America and Oceania, to combine their established expertise in each individual research field to jointly tackle the comprehensive problem

of designing a molecular structure, synthesising it, characterising, and testing its effectiveness as an optoelectronic active material. Such coordinated approach is practised only by top scientific establishments in the world, giving our team a unique opportunity to adopt state-of-the art scientific topic and a cutting-edge approach to investigate it. The project will offer a unique opportunity to establish an efficient connection between the partners with different, although complementary expertise, thus allowing a multidisciplinary approach to solve the practical problems on the interface of organic chemistry, physics, material science, molecular and material engineering for environmentally friendly technologies. The coordinated scientific research within the consortium as well as the staff exchange will be also very favourable for both training and joint research activities, transfer of knowledge and know how between the participating parties, being of mutual interest. The complementarily aspects existing between EU partners and those from Russia, Ukraine, U.S.A. and Australia, as well as the multidisciplinary character of proposed research will create sufficient synergy to succeed the targeted goals and will result in cross-fertilization of the consortium as a whole.

Table 1: List of Work Packages

Work package n°	**Work package title**	***Beneficiary* / Partner organisation short name**	**Start month**	**End month**
0	Project management	*SilUT*, UStrath, KnsUT, IPChPh, LvivPNU, UoW, GTech	1	48
1	Design and selection of promising monomers by quantum-chemical methods	*GTech*, SilUT, UStrath, KnsUT	1	30
2	Synthesis of donor – acceptor molecules selected using quantum mechanical calculations	*KnsUT*, UStrath, UoW	6	35
3	Comprehensive physicochemical, electrochemical and spectroelectrochemical characterisation of synthesised compounds	*SilUT*, UStrath, KnsUT, IPChPh, UoW	11	40
4	Study of electrical and optical properties of thin layers of selected materials	*IPChPh*, SilUT, UStrath, KnsUT, UoW	14	43
5	Construction of prototype electrochromic and electroluminescent devices	*IPChPh*, SilUT, UStrath, KnsUT, UoW	18	47
6	Assessment of experimental results to refine the research procedures and quantum-chemical methods for selection of molecules	*GTech*, *SilUT*, UStrath, KnsUT, IPChPh, UoW	23	48

Table 2: Work Packages

Work package number	**0**	**Start date or starting event:**	Month 1
Work package title	Project management		
***Beneficiary* / Partner Organisation short names**	SilUT, UStrath, KnsUT, IPChPh, LvivPNU, UoW, GTech		

Objectives
Coordination of research efforts, running the exchange of scientists, organizing joint actions for the dissemination of results and reporting

Description of work

Task 0.1: Implementation of the project master plan

The project master plan assumes that two principal research cycles comprising successive implementation of the work packages 1 to 6, detailed in this section, are to be carried out. The plan assumes a flow of results and information to take place with results of an ongoing work package being the basis for commencement of the next one. In this way scientific efforts will be coordinated and structured assuming a sequence of the following steps is adopted:

- Selection of most promising molecules by prediction of their properties using quantum chemical calculations,
- Synthesis of the elected chemical compounds,
- Comprehensive physicochemical characterisation of synthesised compounds using a suite of spectroscopic and electrochemical techniques – first instance of verification of the theoretically predicted properties. Selection of most promising compounds for further studies,
- Investigation of thin film properties of selected compounds – identification of best candidates for test optoelectronic device fabrication,
- Fabrication of test electrochromic cells and electroluminescent devices. Determination of working parameters of these devices and comparison with ones available commercially or reported in other studies.
- Analysis of the results obtained. Identification of structure-property relationships. Assessment of the accuracy and correctness of theoretical predictions with real life results. Modification or change of quantum chemical computational models for the second set of molecules to be investigated.
- Commencement of the second research cycle.

Task 0.2: Scientific management

Task 0.3: Administrative management

Task 0.4: Knowledge transfer management

Task 0.5: Dissemination of results management

Deliverables

D0.1: Report following 12 months of project implementation
D0.2: Report following 24 months of project implementation
D0.3: Report following 36 months of project implementation
D0.4: Report following 48 months of project implementation – final report

***Researchers* involved**

Members of the project's Management Council (see table 6) and staff recruited or appointed by them.

Work package number	**1**	**Start date or starting event:**	Month 1
Work package title	Design and selection of promising monomers by quantum-chemical methods		
***Beneficiary* / Partner Organisation short names**	*GTech*, SilUT, UStrath, KnsUT		

Objectives

The objective of this workpackage is to describe a wide range of potential monomers with quantum-chemical methods and select the most promising candidates for further research.

Description of work

Task 1.1: Selection of a wide range of molecules for quantum-chemical calculations

The workpackage will start by selecting a large group of molecules for quantum-chemical description. The choice will be consulted with the synthesis specialists so that a route to obtaining each molecule is known and the computer simulations are performed for substances yet non-existent, but possible to synthesize.

Our idea is to begin with quantum chemical investigation of basic electronic structure properties of a group of molecules constructed from several conjugated heterocyclic building blocks, in an attempt to consciously select the most promising candidate molecules for subsequent synthesis. The selection criteria would be those that determine the electropolymerisability, chromism and the electrostimulated light emission properties. The building block stock we could choose from includes but is not limited to:

D) nucleophilic units

- thiophenes and substituted derivatives
- selenophenes and their derivatives
- carbazoles
- triphenylamine

A) electrophilic units

- oxazoles (mono and di aza ones), thiazoles and selenazoles
- imidazoles, triazoles, tetrazoles
- benzo or naphtho derivatives of the above
- perylene bisimides, 1,8-naphthalimides

Task 1.2: Geometry optimization of the molecules

Geometry optimization will be done prior to any property-related calculations.

Task 1.3: Calculation of spin density and optical properties of the monomers to indicate candidates that are the most likely to electropolymerise and produce a good photovoltaic device

From our experience we know that Density Functional Theory (DFT) calculations with a moderate-size basis set (for example 6-31G*) can in most cases predict spin density of thiophene derivatives. Knowing this parameter, we will be able to indicate which molecules are the best candidates for synthesis and are most likely to undergo electropolymerisation.

We will evaluate the linear optical properties of the candidate molecules with Time Dependent DFT or Configuration Interaction methods.

Task 1.4: Calculation of structure and optical properties of some polymers resultant from the previous task

We would be interested in studying not only the effect of the conjugated unit composition but also their molecular arrangement (D-A-D, D-A-A-D, D-A-D-D-A-D etc...). The longer the starting monomer (oligomer) the better defined the polymer microstructure is and our experience, confirmed by some recent papers, suggest that such compounds can polymerise subject to sufficient redox charging (eg. radical trication), paving way to development of well-defined electrosynthesised conjugated polymers.

Several parameters of the formed polymer will be evaluated *in silico*, including absorption spectra and exited state energy (and thus the color that will be absorbed and emitted by the resultant optoelectronic device) and conjugation between the unit moieties of the polymer (correlated with electroconductivity). It will also be interesting to determine how the molecular arrangement of the conjugated unit influences the energy and oscillator strength of electronic transitions during light absorption, as it is the key parameter defining the efficiency of energy transition between light and electrons.

Deliverables

D1.1: Optimized geometries of the selected molecules
D1.2: List of selected best candidate molecules for the organic synthesis teams
D1.3: Report of accomplished scientific actions following completion of the first research cycle
D1.4. Report of accomplished scientific actions following completion of the second research cycle

D1.4: Short accounts of scientific experience gain prepared by each early-stage exchange beneficiary.

***Researchers* involved**

Members of prof. Jean-Luc Bredas' group (GTech) (see point B 3.1) and staff seconded to them.

Work package number	**2**	**Start date or starting event:**	Month 6
Work package title	Synthesis of donor – acceptor molecules selected using quantum mechanical calculations		
***Beneficiary* / Partner Organisation short names**	*KnsUT*, UStrath, UoW		

Objectives

Preparation of monomeric, oligomeric and polymeric compounds containing ordered architectures of donor-acceptor systems.

1. Synthesis of donor-acceptor conjugated monomers and oligomers.
2. Preparation of polymers based on the obtained monomers and oligomers.
3. Investigation of elementary properties of the obtained materials.

Description of work

Donor and acceptor "building blocks" for novel conjugated systems.

Due to the experience of the teams involved in this Work Package, it is possible to adopt a "building block" approach to individual donor and acceptor systems. Basing on a wide variety of those systems, compounds will be "built" – individual systems attached to each other in a controlled way, to produce well-defined molecular architectures.

Task 2.1: Synthesis of compounds containing donor-acceptor systems.

Based on quantum chemical computations performed in work package 1, the most promising monomers and oligomers were selected. This data will be implemented, through the synthesis of compounds containing donor-acceptor systems. The systems will be arranged within monomer and oligomer molecules, featuring architectures such as D-A-D, D-A-A-D and D-A-D-D-D-A-D, where D and A denote the donor and acceptor systems respectively. The aforementioned arrangement shall be obtained through the use of coupling techniques dependent on the nature of the systems to be linked.

Apart from conventional methods such as Tucker iodination, Catogan ring closure reactions or Vilsmeier formylation modern methods will be used for the synthesis of donor–acceptor molecules. Ullmann and Buchwald-Hartwig reactions will be used for the formation of C-N linkages in aromatic moieties, Suzuki-Miyaura coupling and Yamamoto reactions will be used for the formation of C-C linkages. Wittig reactions will be used for the preparation of stilbene analogues. Shonagashira reactions will be employed for the preparation of the compounds having ethynyl linkages. Some of these methods will also be used for the synthesis of electroactive polymers and oligomers by step growth polymerization.

Task 2.2: Identification and purification of obtained systems.

Upon successful synthesis of each novel monomer and oligomer, it will be studied to determine its exact identity and purity. The techniques utilized in this investigation include Nuclear Magnetic Resonance Spectroscopy (NMR), Mass Spectroscopy (MS) and elemental analysis. Identification will be followed by purification – the method for this will be chosen based on the nature of each individual compound. The standard compliment of silica gel column chromatography, recrystallization, sublimation or gel permeation chromatography (GPC) will be used for this goal.

Task 2.3: Investigation of basic properties of the monomers and oligomers.

Purified samples of each of the synthesized compounds will be examined in order to determine their physicochemical, thermal, optical and electrochemical properties. Thermal analysis will be facilitated

through the use of Differential Scanning Calorimetry (DSC),as well as Thermal Gravimetric Analysis (TGA). This will produce information about any phase changes or decomposition of the materials at elevated temperatures, which serves to determine the operational temperature window of prospective devices based on the investigated donor-acceptor system. The products will be investigated in detail in Work Package 3.

Task 2.4: Preparation of polymers containing donor-acceptor systems.

Based on synthesized monomers and oligomers, polymeric material will also be prepared chemically. This approach will allow to both expanding the matrix of available materials, as well as enable comparison of properties between polymers synthesised chemically and electrochemically.

Deliverables

D2.1: Synthesised monomers
D2.2: Chemically Synthesised polymers
D2.3: Report of accomplished scientific actions following completion of the first research cycle
D2.4. Report of accomplished scientific actions following completion of the second research cycle
D2.4: Short accounts of scientific experience gain prepared by each early-stage exchange beneficiary.

***Researchers* involved**

Members of prof. Juozas Grazulevicius' group (KnsUT), prof. Peter Skabara's group (UStrath) and dr Pawel Wagner (UoW) (see point B 3.1) and staff seconded to them.

Work package number	**3**	**Start date or starting event:**	Month 11
Work package title	Comprehensive physicochemical, electrochemical and spectroelectrochemical characterisation of synthesised compounds.		
***Beneficiary* / Partner Organisation short names**	*SilUT*, UStrath, KnsUT, IPChPh, UoW		

Objectives

The main objective is to characterise the physicochemical properties, including optical and electrochemical, of new ambipolar compounds synthesised in work package 2 for electroluminescence and electrochromic polymer semiconductors. The objective of this work is to study fundamental properties of spin charge carriers stabilized and initiated in polymer semiconductors aiming to determine correlations and optimization of their spin-assisted electronic and optical properties for the further use in appropriate molecular optoelectronic devices.

Description of work

Task 3.1: The basic optical, fluorescence and electrochemical analysis of basic compounds

The basic compounds will be characterized by spectral methods to determine their basic optical properties and fluorescence activity. Electrochemical methods will be used in order to determine oxidation, reduction potentials and electropolymerization conditions.

Task 3.2: Deposition of polymers and their electrochemical characteristic

Polymers will be obtain on electrochemical or chemical routes. Cyclic voltammetry will be used to obtain polymers from monomer solutions. In the next step conjugated polymers will be characterized by electrochemical methods to determine their oxidation and reduction potentials and assessment of electrochemical stability of these organic compounds during multiple doping and dedoping processes. HOMO and LUMO energy as well as an electrochemical energy gap will be estimated from electrochemical results. UV-vis-NIR analyses of polymer films will be used to estimation of the optical band gap. This characteristic will allow to verify the basic properties of compounds and allow to choice the

materials with best perspectives to further research.

Task 3.3: In-situ Electron Paramagnetic Resonance, UV-vis-NIR and Raman spectroelectrochemical studies

Complex studies of pre-, in-situ and post-doping process of investigated systems using EPR coupled with electroanalytical and UV-Vis-NIR techniques will be made. Doping induced spin-bearing species will be investigated. Static and dynamic in-situ spectroelectrochemical measurements of changes in paramagnetic properties of investigated systems, qualitaive and quantitative analyses of doping proces parameters combining the results of electrochemical and spectroscopic studies will be made. Characterization of redox mechanism as well as intermediate and possible by-products of the doping process.

Raman microscope coupled with electroanalytical techniques will be employed to investigate the doping process. Vibrational spectra will provide information on the structural changes occurring in conjugated polymer chain during doping processes. Moreover Raman spectroscopy could provide additional information about material properties.

Task 3.4: EPR study the magnetic, relaxation and dynamics properties of charge carriers stabilized in darkened polymer semiconductors

Initial and nanomodified organic polymer semiconductors constructed from nucleophilic (thiophenes, selenophenes, carbazoles) and electrophilic (oxa-, thia-, selena-, imida-zoles) blocks will be sudied mainly at 3-cm waveband EPR. Diphenylpicrylhydrazyl (DPPH) and 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO) will be used as standards for estimation of g-factor and concentration of spin charge carriers, respectively. Deconvolution of non-saturated absorption EPR and LEPR spectra and their further doubly integration will allow us to identify all spin charge carriers in this sample and determine all terms of their magnetic susceptibility. This procedure permits to control the quantum and field (magnetic, electric) effects on the magnetic, relaxation and dynamics parameters of all charge carriers stabilized and/or treatment-induced in these systems. Experimental spectra will be processed and then software simulated. After that all relaxation parameters of spin charge carriers will be determined separately using the steady-state saturation method. From the data obtained will be calculated coefficients of anisotropic spin diffusion in these sample by using appropriate spectral density functions. Moreover, the homogeneity of the structures will be estimated before and after sample treatment by using scanning autoemission microscope. Therefore, from this part the experimental and theoretical knowledge can be obtained for the further testify the influence of the precursors' physical properties on the above parameters of the new systems. Scientific Report will be made after this part of the project and will be sent to Coordinator as required.

Task 3.5: LEPR study the magnetic, relaxation and dynamics properties of charge carriers photoinitiated in polymer semiconductors

EPR and LEPR spectra will be measured at background illumination of the samples placed into MW cavity by white and monochromic solid-state light sources within wide regions of photon energy (1.3 - 2.7 eV), temperature (77-340 K), irradiation conditions and then identified analogously to that as it is described above. Comparing the data obtained by both approaches, we will set up new methodology allowing us to analyse how the main magnetic resonance, relaxation and dynamics parameters of each spin charge carriers govern structural, conformation and composition of new polymer semiconductors. Moreover, in order to clarify the results obtained they will be compare with their optical absorption spectra obtained using a Shimadzu UV-VIS-NIR scanning UV-3101PC spectrophotometer. This will allow estimating more detailed the correlations of optical features with such fundamental (magnetic, relaxation and dynamics) properties of spin charge carriers necessary for the further design of newel organic electronic devices. Such correlations will also be used for controllable synthesis of various organic semiconductors using optimal precursors. LEPR investigation of the domestic paramagnetic centers and charge carriers photoexcited in the initial and nanotreaded polymers will give a possibility to control and optimise their texture and other structural properties over the entire range of temperatures studied, conditions of illumination and, therefore, will open new horizon for the further creation of flexible and scalable organic molecular devices with spin-assisted electronic properties.

Task 3.6: Simultaneous EPR study of the DC and AC conductivity

The dynamics of spin charge carriers in highly-doped polymer semiconductors will be studied with the absence and presence of MW field. Because polymer semiconductor is disordered system of crystalline domains embedded into amorphous matrix, electronic processes occurring in it concern some scales. At the

chain scale, microwave (EPR) conductivity let intrinsic metallic behaviour appear, whereas static conductivities reveal the importance of long-range correlations and cluster effects. The intrinsic conductivity will be determined analysing Dysonian EPR spectra of such polymer systems before and after their doping even directly in MW cavity. It will allow us to determine separately spin/charge transfer inside nanocrystallites and between them during the its crossing amorphous polymer matrix. Besides, the diffusion coefficients, respective transfer integrals and mechanisms of charge transfer will be determined. This will supply us with important correlations of the polymer's structure, crystallinity and conformation with its main electronic properties depending on the number and structure dopants introduced. This part of the experiments will be accompanied with DC measurements of the initial and treated polymer films. The above mentioned microscopic analysis will be applied as well. Moreover, some materials will be additionally treated with nanoadducts in order to stabilize their optoelectronic properties at the wide spectral range.

Deliverables

D3.1: Selection of best candidate molecules for thin films studies in work package 4
D3.2: Report of accomplished scientific actions following completion of the first research cycle
D3.3. Report of accomplished scientific actions following completion of the second research cycle
D3.4: Short accounts of scientific experience gain prepared by each early-stage exchange beneficiary.

***Researchers* involved**

Members of prof. Mieczyslaw Lapkowski's group (SilUT), prof. Juozas Grazulevicius' group (KnsUT), prof. Peter Skabara's group (UStrath), dr Victor Krinichnyi (IPChPh), and dr Pawel Wagner (UoW) (see point B 3.1), and staff seconded to them.

Work package number	**4**	**Start date or starting event:**	Month 14
Work package title	Study of electrical and optical properties of thin layers of selected materials		
***Beneficiary* / Partner Organisation short names**	*IPChPh*, SilUT, UStrath, KnsUT, UoW		

Objectives

The objective of this work package is to fabricate thin solid films of good quality and its comprehensive characteristics. This work will be used for further multilayer device fabrication and characterization.

Description of work

Thin films will be prepared by appropriate method and their structural and morphological characterization will be performed by adequate advanced methods. Methods that will give good quality films will be used for multilayer devices fabrication. The device electrochemical and optical properties and its stability will be investigated.

Task 4.1: Thin solid film fabrication

The solid state layers from soluble starting material will be prepared with various conventional techniques including immersion method (dip coating), Langmuir-Blodget method, spin coating, and ink jet printing. We expect that in some cases the choice of the method can influence materials morphology and consequently its properties. Some of material will be insoluble in common solvents, the solid state layers will then be obtained directly from the chemical or electrochemical polymerization on the surface.

Task 4.2: Film morphology and quality characterization

Already prepared layers must be accurately characterized. Many properties strongly depend on the material morphology, also important factor are thin film quality and thickness.

For layers characteristics we are going to use the spectroscopic ellipsometry which is non-destructive and contactless technique. Upon the analysis of the change of polarization of light, which is reflected off a sample, ellipsometry can yield information about layers that are thinner than the wavelength of the probing light itself, even down to a single atomic layer. Ellipsometry can yield information about layers porosity, homogeneity and thickness. The film morphology and surface quality will be investigated by mean of AFM or STM microscope. These methods can be also used for very thin layers thickness measurements.

In some cases the STM technique can be also used for step by step local electrochemical polymerization to make pixel-like structure on surface.

Task 4.3: Material electrical parameters characteristics

Electrochemical Impedance Spectroscopy (EIS) is a very sensitive technique which can give us a lot of important information about material. It is based on modelling of equivalent circuit being a combination of simple elements (resistors, capacitors and inductors) that gives identical electrical response for some disturbances as examined material. Information on relaxation processes, bulk and interface characteristics for structures based on organic materials can be obtained using electrical impedance spectroscopy. The analysis of Nyquist diagrams and corresponding electrical circuits, obtained using computerized parametric identification, that simulate charge transfer through of the films will be carried out. Frequency dependences of impedance (Z) will be analyzed by graphic-analytical method using a ZView 2.3 (Scribner Associates) package. The electrochemical processes in the films will be modeled.

From these research we are going to calculate various electrical parameters of material e.g. capacitance, conductance, diffusion coefficients, charge mobility or redox process kinetics. The EIS technique is especially valuable for complex characteristics of multilayered structures which include processes ongoing on each layer interfaces. It is then suitable for prototypic device characteristics.

Task 4.4: Dynamic electrical measurements for materials and devices stability studies

A special variation of EIS is the DEIS (Dynamic Electrochemical Impedance Spectroscopy), which can be used in a dynamic and cyclic measurements. This technique allows us to see if material certain properties (e.g. capacity, or resistance) will change in dynamic processes it is therefore ideal for testing the stability of the materials and multilayer devices in the cyclic process.

Task 4.5: Fluorescence and electroluminescence studies

We expect to obtain materials that will exhibit fluorescent and preferably electroluminescent properties. The fluorescence wavelength and efficiency will be investigated for thin layers while electroluminescence for prototype devices.

Deliverables

D4.1: Optimum thin-layer fabrication procedures for compounds studied
D4.2: Report of accomplished scientific actions following completion of the first research cycle
D4.3. Report of accomplished scientific actions following completion of the second research cycle
D4.4: Short accounts of scientific experience gain prepared by each early-stage exchange beneficiary.

***Researchers* involved**

Members of dr Victor Krinichnyi (IPChPh), prof. Mieczyslaw Lapkowski's group (SilUT), prof. Juozas Grazulevicius' group (KnsUT), prof. Peter Skabara's group (UStrath), and dr Pawel Wagner's group (UoW) (see point B 3.1), and staff seconded to them.

Work package number	**5**	**Start date or starting event:**	Month 18
Work package title	Construction of prototype electrochromic and electroluminescent devices		
***Beneficiary* / Partner Organisation short names**	*LvivPNU*, UStrath, UoW		

Objectives

Development of prototype electrochromic and electroluminescent devices targeted for practical applications.

1. Design of electrochromic and electroluminescent devices and their optimization through the use of different construction elements.
2. Investigation of device operating characteristics and their optimization through varying input parameters.
3. Assembly of devices according to the optimized designs and assessment of their potential for up-scaling.

Description of work

Device designs tailored to individual polymer systems.

The wide array of polymer building blocks chosen for the project ensures that during its execution, a number of different polymer systems will be directed for study in prototype devices. Each of those polymers is expected to exhibit different electrochemical and spectroelectochemical properties, which expressly implies the need for a highly individualized approach to their investigation. Therefore, to maintain the highest standards of scientific excellence, it is imperative to determine the specific conditions required for the electroactive layer to achieve maximum performance.

Only when the above condition is satisfied, optimized devices will be assembled for the assessment of their operating parameters. Electrochromic (EC) and electroluminescent (EL) devices will be studied primarily through UV-Vis-NIR spectroelectrochemistry.

Information feedback for additional synergy.

Data procured during experiments on polymer films in assembled devices will be analyzed and fed back to Work Packages 1 and 2. This will help direct the teams responsible for design and synthesis of monomers towards the most promising systems. Capitalizing on gathered practical information as well as theoretical guidelines, this approach allows for greater synergy of efforts undertaken by the teams involved.

Quality of devices through exploration and optimization of parameters.

Electroactive devices consist of an optically transparent substrate (OTS), a polymer film applied onto it and an electrolyte. Synergy of those three elements is crucial to achieving excellence in the assembled devices. Therefore, it is necessary to optimize the components of the devices as well as their operating parameters. This will be realised through assembling three generations of prototypes, each of those featuring different aspects of optimization.

Focus on performance – a direct path to implementation.

Basic research is the backbone of innovation, however, innovation results from practical application. Adhering to the above, the end goal of this Work Package is to utilise the information and experience gained from Work Packages 1-4 in the development of prototype devices. This necessitates achieving the highest possible performance for each prospective system that will be investigated. Only then can the standards, set by the manufacturers of electrochromic and electroluminescent devices, be met and exceeded.

Task 5.1: First generation prototypes for preliminary investigation.

Basic electrochromic (EC) and electroluminescent (EL) devices will be assembled for optimization of principle design and preparation elements. The type of optically transparent substrate (OTS), the method of applying the polymers onto the substrates and the electrolyte system utilised by the device will be studied. The aforementioned variables constitute a three dimensional parameter space, which will be explored for each polymer, in order to achieve the best performance of the electroactive layer.

Indium-tin oxide (ITO) and fluorinated tin oxide (FTO) deposited on glass slides, as well as doped zinc oxide (ZnO), deposited on flexible substrates, will be examined as potential OTS materials for the devices. Polymers will be applied to the substrates through direct electropolymerisation, spin coating and dip coating. Thermovacuum methods will also be explored as means of obtaining high quality electroactive layers. The electrolyte systems investigated with each polymer will be chosen based on the overlap of their windows of operating potentials as well as the conductivity of the electrolyte. Designs featuring innovative geometry of the EL devices will also be explored.

Task 5.2: Second generation prototypes for assessment of operating parameters.

Electrochromic and electroluminescent devices will be assembled, integrated with respective instruments for spectroelectrochemical measurements.

The primary method of determining the operating parameters of EC devices is UV-Vis-NIR spectroelectrochemistry. Spectrochronoamperometric measurements will be performed to determine spectral contrast along the registered spectrum at set potentials. Those potentials typically correspond to the polymer in its ground state, the oxidized polymer and the reduced polymer, however, as many potentials as necessary may be investigated. Multi-step spectrovoltammetry, on the other hand, will be used to determine colour switching times. EL devices will be studied through J-V curve measurements, electroluminescence spectral measurements and impedance spectroscopy methods for a better understanding of the physical phenomena and more sustainable and innovative exploitation of the devices. The stability of device operating parameters shall be investigated for both types of assemblies.

Results obtained during the progress of this task will be analyzed to find the most promising types of systems among those investigated. This information will be passed on to Work Packages 1 and 2.. This approach will allow the teams to narrow down the scope of planned syntheses to selected groups of polymers, exhibiting the most advantageous properties. Those groups will then be explored further, in search of individual polymers for the construction of third generation prototypes.

Task 5.3: Third generation prototypes for optimization of final device designs.

Selected electroactive systems (OTS, polymer film and electrolyte), developed in the previous Task 5.2, will be the subject final investigation and optimization. The assembled devices will be examined in adherence to the requirements posed to commercially available EC and EL devices. Apart from standards for operating parameters, a major criterion of practical application is the ability to scale the devices up. Therefore, the primary focus of this task will be the optimization of the systems towards meeting this criterion.

Deliverables

D5.1: Technologically simple fast electrochromic optical elements for flexible organic display units will be demonstrated.
D5.2: Report of accomplished scientific actions following completion of the first research cycle
D5.3. Report of accomplished scientific actions following completion of the second research cycle
D5.4: Short accounts of scientific experience gain prepared by each early-stage exchange beneficiary.

***Researchers* involved**

Members of prof. Pavlo Stakhira group (LvivPNU), prof. Peter Skabara's group (UStrath), and dr Pawel Wagner (UoW) (see point B 3.1) and staff seconded to them.

Work package number	**6**	**Start date or starting event:**	Month 23
Work package title	Assessment of experimental results to refine the research procedures and quantum-chemical methods for selection of molecules		
***Beneficiary* / Partner Organisation short names**	*GTech*, *SilUT*, UStrath, KnsUT, IPChPh, UoW		

Objectives

The objective of this workpackage is to summarise of the study done so far and provide guidelines and improvement of the research procedures to be used in the subsequent workpackages.

Description of work

Task 6.1: Summary of the results obtained in the project

In this task we will summarize the previous research. In order to do so we will attempt to answer the following questions:

1. Has the research procedure been successful and efficient?
2. Which optoelectronic materials are the best from the point of view of potential applications?
3. In what direction should the further research be conducted?
4. Has the transfer of knowledge and experience been efficient?
5. What can be done to ensure long-lasting collaboration with third party countries?
6. How can the research procedure be improved?
7. What went wrong in the project and why?
8. How can the unresolved issues be addressed?

As usual in experimental work, we expect to obtain some unexpected results. An attempt to provide explanation for such results will be made as well.

Task 6.2: Refinement of the computational procedures

In this task we will evaluate the accuracy of our theoretical predictions against the real life physicochemical and working parameters of the materials and devices constructed using them. The results of this evaluation would enable us to modify, amend or change the selection of quantum chemical computation procedures to be used in a second, abovementioned scientific sequence round, this time with a new set of molecules.

Task 6.3: Preparation of new guidelines for further research

Using the report prepared in Task 1 we will prepare guidelines to improve and accelerate future research.

We will use the know-how and experience obtained during the project to refine the 2nd research cycle. Thus, the AmbiPOD project will be a self-improving undertaking aimed at research efficacy and scientific excellence.

Deliverables

D6.1: Selection of optimal quantum-chemical methods
D6.2: Guidelines for the next research cycle
D6.2: Report of accomplished scientific actions following completion of the first research cycle
D6.3. Report of accomplished scientific actions following completion of the second research cycle

***Researchers* involved**

prof. Mieczyslaw Lapkowski (SilUT), prof. Jean-Luc Bredas (GTech), prof. Juozas Grazulevicius (KnsUT), dr Victor Krinichnyi (IPChPh), prof. Pavlo Stakhira (LvivPNU) and dr Pawel Wagner (UoW).

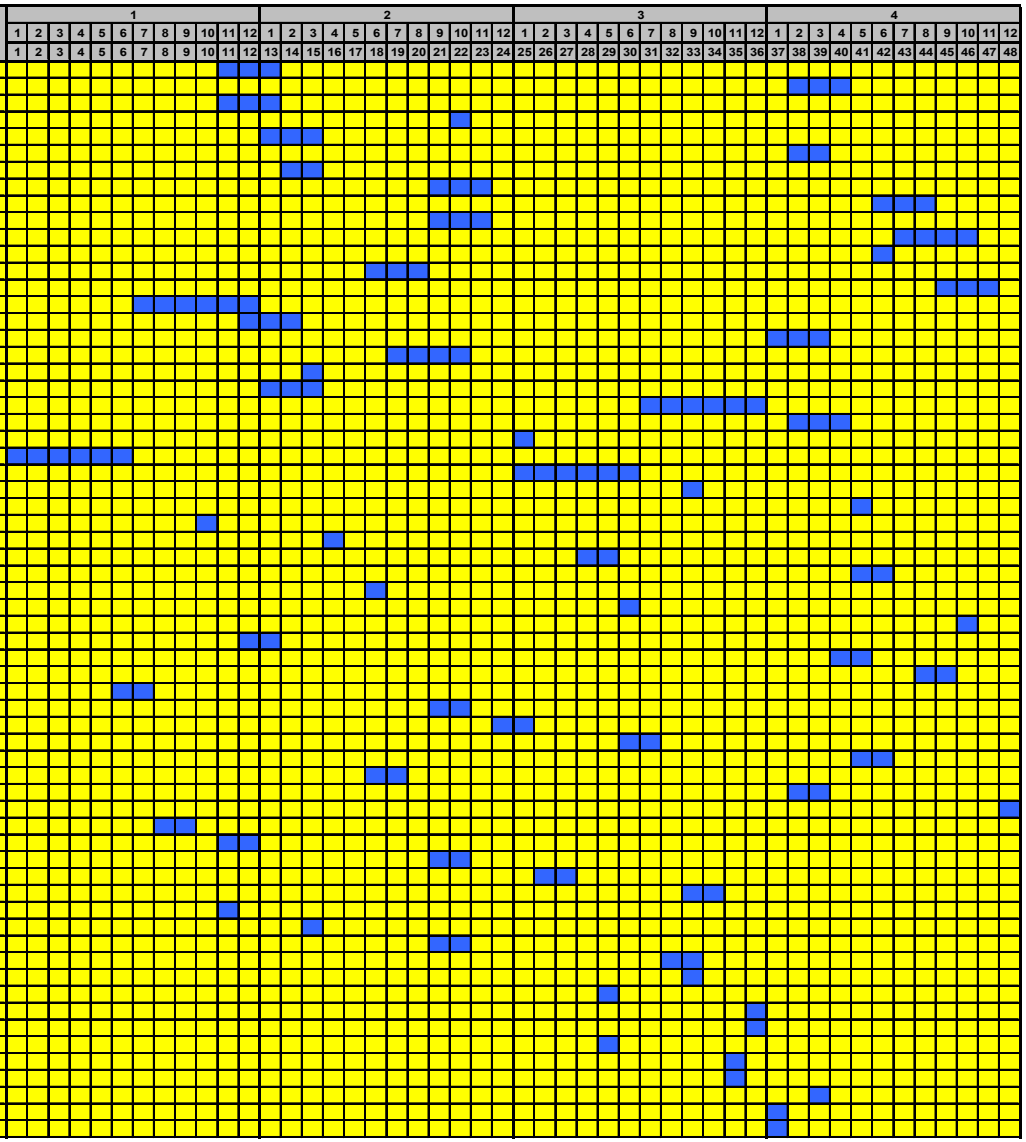
Table 3: List of Milestones

List and schedule of milestones					
Milestone n°.	**Milestone name**	**WPs n°**	**Lead Beneficiary / Partner organisation short name**	**Delivery date**	***Comments***
1	Completion of quantum chemical calculations	1	**GTech,** SilUT, UStrath, KnsUT	6 month	Quantum chemical calculation of various donor-acceptor compounds in order to select best candidates for synthesis.
2	Synthesis of selected compounds	2	**UStrath**, KnsUT, UoW	11 month	Synthesis of most promising molecules based on quantum chemical calculations results

3	Electrochemistry of compounds	3	**SilUT**, UStrath, KnsUT, IPChPh, UoW	16 month	Electrochemical and spectroelectrochemical (UV/EPR/RAMAN/IR) characterization of synthesised molecules
4	Fabrication of thin layers	4	**IPChPh**, SilUT, UStrath, KnsUT, UoW	18 month	Optimization of conditions of various fabrication methods in order to obtain high quality thin layers
5	Electronic and optical properties of thin layers	4	**IPChPh**, SilUT, UStrath, KnsUT, UoW	19 month	Study of electrical and optical properties of formed thin films, such as charge mobility, conductivity, optical absorbance etc.
6	Fabrication of optoelectronic devices	5	**LvivPNU**, UStrath, UoW	22 month	Optimization of conditions of fabrication process, in order to obtain high quality optoelectronic devices
7	Characterization of optoelectronic devices based	5	**LvivPNU**, UStrath, UoW	23 month	Characterization of optoelectronic properties of created devices, such as optical contrast, electroluminescence efficiency etc.
8	1st Research cycle evaluation. Commencement of 2nd research cycle.	6	**SilUT,** GTech	24 month	Summary of research cycle in order to gather experience and knowledge required in next research cycle. Selection of new compounds on basis of acquired experiences.
9	Quantum chemical calculations (2nd)	1	**GTech**, SilUT, UStrath, KnsUT, IPChPh, UoW	30 month	Quantum chemical calculation of molecules chosen on basis of experiences gathered from 1st research cycle. selection of compounds for synthesis (2nd)
10	Synthesis of selected compounds (2nd)	2	**UStrath**, KnsUT, UoW	35 month	Synthesis of most promising molecules based on quantum chemical calculations (2nd)
11	Electrochemistry of compounds (2nd)	3	**SilUT**, UStrath, KnsUT, IPChPh, UoW	40 month	Electrochemical and spectroelectrochemical (UV/EPR/RAMAN/IR) characterization of synthesised molecules (2nd)
12	Fabrication of thin layers (2nd)	4	**IPChPh**, SilUT, UStrath, KnsUT, UoW	42 month	Optimization of conditions of various fabrication methods in order to obtain high quality thin layers (2nd)
13	Electronic and optical properties of thin layers (2nd)	4	**IPChPh**, SilUT, UStrath, KnsUT, UoW	43 month	Study of electrical and optical properties of formed thin films (2nd), such as charge mobility, conductivity, optical absorbance etc.
14	Fabrication of optoelectronic devices (2nd)	4	**LvivPNU**, UStrath, UoW	46 month	Optimization of conditions of fabrication process, in order to obtain high quality optoelectronic devices (2nd)
15	Characterization of optoelectronic devices (2nd)	5	**LvivPNU**, UStrath, UoW	47 month	Characterization of optoelectronic properties of created devices (2nd), such as optical contrast, electroluminescence efficiency etc.
16	2nd Research cycle evaluation	6	**SilUT**, UStrath, KnsUT, IPChPh, LvivPNU, UoW, GTech	48 month	Summary of research cycle in order to gather, evaluate and draw conclusions from the work carried out.

Table 4: Gantt chart of secondments

PARTICIPANT NUMBER	ORIGIN PARTNER	ORIGIN COUNTRY	HOST PARTNER	HOST COUNTRY	SECONDED TYPE	WORK PACKAGE	DURATION (MONTHS)	STARTING MONTH
1	SilUT	EU/AC	IPChPh	ICPC	ESR2	3	3	11
1	SilUT	EU/AC	IPChPh	ICPC	ESR6	4	3	38
1	SilUT	EU/AC	IPChPh	ICPC	ESR7	4	3	11
1	SilUT	EU/AC	IPChPh	ICPC	ER1	4	1	22
1	SilUT	EU/AC	IPChPh	ICPC	ER2	3	3	13
1	SilUT	EU/AC	IPChPh	ICPC	ER4	4	2	38
1	SilUT	EU/AC	IPChPh	ICPC	ER7	3,4	2	14
1	SilUT	EU/AC	LvivPNU	ICPC	ESR2	5	3	21
1	SilUT	EU/AC	LvivPNU	ICPC	ESR3	5	3	42
1	SilUT	EU/AC	LvivPNU	ICPC	ESR7	4	3	21
1	SilUT	EU/AC	LvivPNU	ICPC	ESR8	4,5	4	43
1	SilUT	EU/AC	LvivPNU	ICPC	ER1	5	1	42
1	SilUT	EU/AC	LvivPNU	ICPC	ER6	5	3	18
1	SilUT	EU/AC	LvivPNU	ICPC	ER7	5	3	45
1	SilUT	EU/AC	UoW	TC	ESR1	2	6	7
1	SilUT	EU/AC	UoW	TC	ESR3	3	3	12
1	SilUT	EU/AC	UoW	TC	ESR4	4	3	37
1	SilUT	EU/AC	UoW	TC	ESR5	5	4	19
1	SilUT	EU/AC	UoW	TC	ER1	3	1	15
1	SilUT	EU/AC	UoW	TC	ER2	4	3	13
1	SilUT	EU/AC	UoW	TC	ER3	2	6	31
1	SilUT	EU/AC	UoW	TC	ER6	4	3	38
1	SilUT	EU/AC	GTech	TC	ER1	1	1	25
1	SilUT	EU/AC	GTech	TC	ER5	1	6	1
1	SilUT	EU/AC	GTech	TC	ER5	1	6	25
2	UStrath	EU/AC	IPChPh	ICPC	ESR1	3	1	33
2	UStrath	EU/AC	IPChPh	ICPC	ESR2	3	1	41
2	UStrath	EU/AC	IPChPh	ICPC	ER1	3	1	10
2	UStrath	EU/AC	IPChPh	ICPC	ER2	3	1	16
2	UStrath	EU/AC	IPChPh	ICPC	ER3	3	2	28
2	UStrath	EU/AC	IPChPh	ICPC	ER4	3	2	41
2	UStrath	EU/AC	LvivPNU	ICPC	ESR1	4	1	18
2	UStrath	EU/AC	LvivPNU	ICPC	ESR2	4	1	30
2	UStrath	EU/AC	LvivPNU	ICPC	ESR3	4	1	46
2	UStrath	EU/AC	LvivPNU	ICPC	ER1	4	2	12
2	UStrath	EU/AC	LvivPNU	ICPC	ER2	4	2	40
2	UStrath	EU/AC	LvivPNU	ICPC	ER3	4	2	44
2	UStrath	EU/AC	UoW	TC	ESR1	5	2	6
2	UStrath	EU/AC	UoW	TC	ESR2	2	2	21
2	UStrath	EU/AC	UoW	TC	ESR3	3	2	24
2	UStrath	EU/AC	UoW	TC	ESR4	2	2	30
2	UStrath	EU/AC	UoW	TC	ESR5	3	2	41
2	UStrath	EU/AC	UoW	TC	ER1	5	2	18
2	UStrath	EU/AC	UoW	TC	ER2	3	2	38
2	UStrath	EU/AC	UoW	TC	ER3	2	2	48
2	UStrath	EU/AC	GTech	TC	ESR1	1	2	8
2	UStrath	EU/AC	GTech	TC	ESR2	1	2	11
2	UStrath	EU/AC	GTech	TC	ESR3	1	2	21
2	UStrath	EU/AC	GTech	TC	ESR4	1	2	26
2	UStrath	EU/AC	GTech	TC	ESR5	1	2	33
2	UStrath	EU/AC	GTech	TC	ER1	1	1	11
2	UStrath	EU/AC	GTech	TC	ER2	1	1	15
2	UStrath	EU/AC	GTech	TC	ER3	1	2	21
2	UStrath	EU/AC	GTech	TC	ER4	1	2	32
3	KnsUT	EU/AC	IPChPh	ICPC	ESR1	3	1	33
3	KnsUT	EU/AC	IPChPh	ICPC	ESR2	3,4	1	29
3	KnsUT	EU/AC	IPChPh	ICPC	ESR4	4	1	36
3	KnsUT	EU/AC	IPChPh	ICPC	ESR5	3	1	36
3	KnsUT	EU/AC	IPChPh	ICPC	ESR6	3	1	29
3	KnsUT	EU/AC	IPChPh	ICPC	ER1	3,4	1	35
3	KnsUT	EU/AC	IPChPh	ICPC	ER5	3	1	35
3	KnsUT	EU/AC	IPChPh	ICPC	ER7	3,4	1	39
3	KnsUT	EU/AC	IPChPh	ICPC	ER8	3	1	37
3	KnsUT	EU/AC	IPChPh	ICPC	ER9	3	1	37



3	KnsUT	EU/AC	LvivPNU	ICPC	ESR1	4,5	1	39
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR3	5	1	38
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR7	5	1	43
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR8	4,5	1	39
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR9	5	1	43
3	KnsUT	EU/AC	LvivPNU	ICPC	ER2	5	1	33
3	KnsUT	EU/AC	LvivPNU	ICPC	ER3	4,5	1	42
3	KnsUT	EU/AC	LvivPNU	ICPC	ER4	5	1	38
3	KnsUT	EU/AC	LvivPNU	ICPC	ER6	4,5	1	33
3	KnsUT	EU/AC	LvivPNU	ICPC	ER7	5	1	42
3	KnsUT	EU/AC	UoW	TC	ESR3	3	1	26
4	IPChPh	ICPC	SiliUT	EC/AC	ESR1	3,4	3	11
4	IPChPh	ICPC	SiliUT	EC/AC	ESR2	3,4	3	36
4	IPChPh	ICPC	SiliUT	EC/AC	ESR3	3	3	43
4	IPChPh	ICPC	SiliUT	EC/AC	ESR4	4	2	23
4	IPChPh	ICPC	SiliUT	EC/AC	ER1	3	4	10
4	IPChPh	ICPC	SiliUT	EC/AC	ER2	3,4	3	11
4	IPChPh	ICPC	SiliUT	EC/AC	ER3	4	3	27
4	IPChPh	ICPC	SiliUT	EC/AC	ER4	4	2	39
4	IPChPh	ICPC	SiliUT	EC/AC	ER5	3,4	3	43
4	IPChPh	ICPC	SiliUT	EC/AC	ER6	3,4	3	27
4	IPChPh	ICPC	SiliUT	EC/AC	ER7	3	2	8
4	IPChPh	ICPC	SiliUT	EC/AC	ER8	3	2	35
4	IPChPh	ICPC	UStrath	EC/AC	ESR1	3,4	3	18
4	IPChPh	ICPC	UStrath	EC/AC	ESR2	3,4	3	30
4	IPChPh	ICPC	UStrath	EC/AC	ESR3	3	3	42
4	IPChPh	ICPC	UStrath	EC/AC	ESR4	4	2	14
4	IPChPh	ICPC	UStrath	EC/AC	ER1	3	2	15
4	IPChPh	ICPC	UStrath	EC/AC	ER2	3,4	3	30
4	IPChPh	ICPC	UStrath	EC/AC	ER3	4	2	39
4	IPChPh	ICPC	UStrath	EC/AC	ER4	4	2	15
4	IPChPh	ICPC	UStrath	EC/AC	ER5	3,4	2	39
4	IPChPh	ICPC	UStrath	EC/AC	ER6	3,4	3	30
4	IPChPh	ICPC	KnsUT	EC/AC	ESR1	3,4	1	6
4	IPChPh	ICPC	KnsUT	EC/AC	ESR2	3,4	2	25
4	IPChPh	ICPC	KnsUT	EC/AC	ESR3	3	2	41
4	IPChPh	ICPC	KnsUT	EC/AC	ESR4	4	1	25
4	IPChPh	ICPC	KnsUT	EC/AC	ER1	3	2	15
4	IPChPh	ICPC	KnsUT	EC/AC	ER2	3,4	2	6
4	IPChPh	ICPC	KnsUT	EC/AC	ER3	4	2	15
4	IPChPh	ICPC	KnsUT	EC/AC	ER4	4	1	23
4	IPChPh	ICPC	KnsUT	EC/AC	ER5	3,4	1	39
4	IPChPh	ICPC	KnsUT	EC/AC	ER6	3,4	2	30
5	LvivPNU	ICPC	SiliUT	EC/AC	ESR4	5	3	18
5	LvivPNU	ICPC	SiliUT	EC/AC	ESR6	3	3	11
5	LvivPNU	ICPC	SiliUT	EC/AC	ER1	5	2	10
5	LvivPNU	ICPC	SiliUT	EC/AC	ER1	5	2	19
5	LvivPNU	ICPC	SiliUT	EC/AC	ER2	4	2	41
5	LvivPNU	ICPC	SiliUT	EC/AC	ER3	5	2	10
5	LvivPNU	ICPC	SiliUT	EC/AC	ER4	4	2	15
5	LvivPNU	ICPC	UStrath	EC/AC	ESR1	5	4	1
5	LvivPNU	ICPC	UStrath	EC/AC	ESR2	4	6	11
5	LvivPNU	ICPC	UStrath	EC/AC	ESR5	4	3	17
5	LvivPNU	ICPC	UStrath	EC/AC	ER2	1,5	3	26
5	LvivPNU	ICPC	UStrath	EC/AC	ER2	5	3	10
5	LvivPNU	ICPC	KnsUT	EC/AC	ESR3	4	4	1
5	LvivPNU	ICPC	KnsUT	EC/AC	ESR4	4	4	38
5	LvivPNU	ICPC	KnsUT	EC/AC	ESR5	5	4	29
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	2
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	14
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	23
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	38
5	LvivPNU	ICPC	KnsUT	EC/AC	ER2	4	3	35
5	LvivPNU	ICPC	KnsUT	EC/AC	ER2	5	3	22
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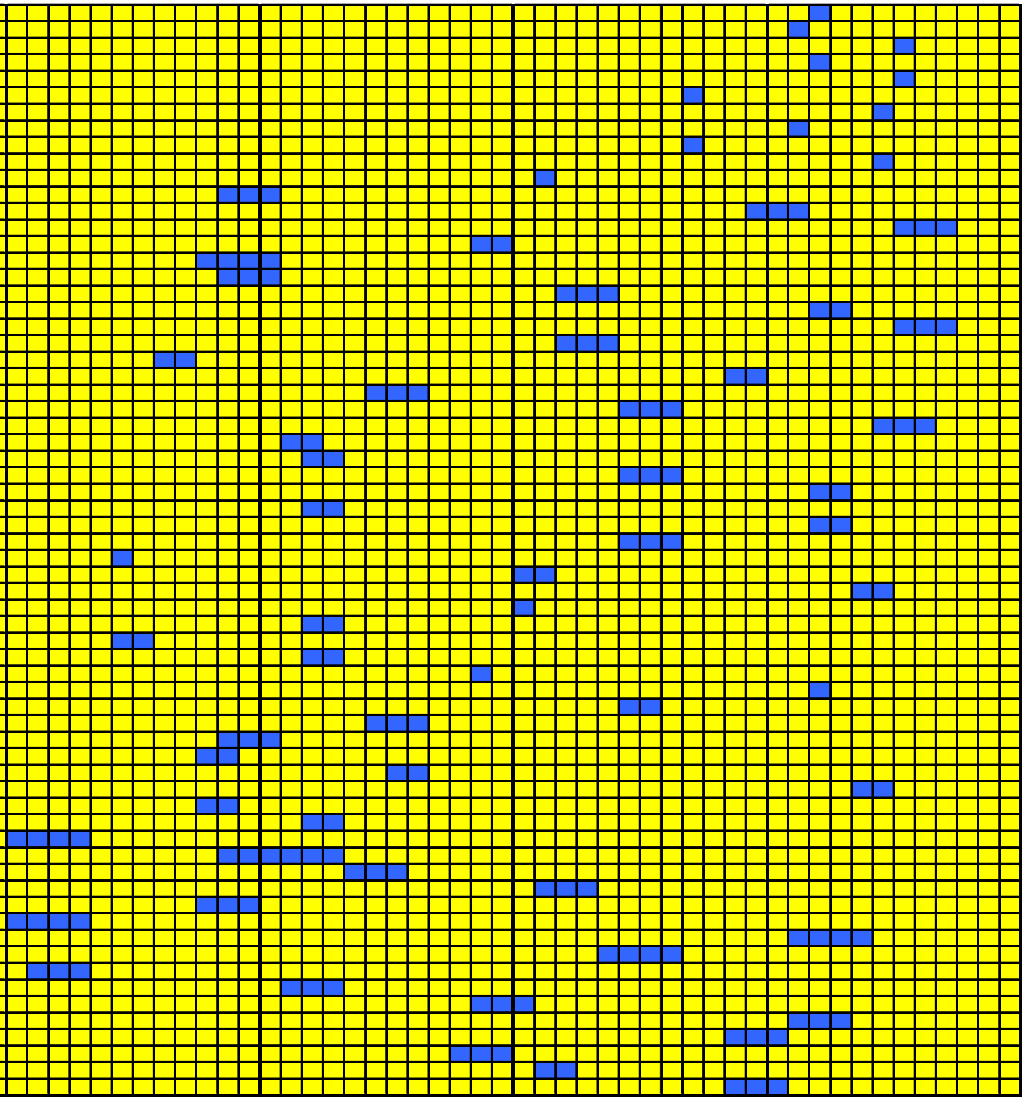


Total eligible researchers months 293

Durations of exchange are set individually for each Work Package, dependent on the specific character of tasks undertaken within them. For synthetic tasks, these exchanges are about five months on average, due the time consuming nature of synthetic processes. Other tasks, related to investigation of obtained samples, therefore, feature shorter exchange times. On average a member of staff is seconded to other institutions for over two months, therefore, approximately one hundred staff members will take part in the exchange rounds. This amount is distributed evenly among the partners, allowing each of the partners to second over dozen staff members. This approach allows the host institutions to train several staff members in each of the research fields represented by the participating groups.

B 1.2 Research quality of the partners

SilUT – Coordinator: Silesian University of Technology

Silesian University of Technology is a big university teaching approximately 33 000 of students. The University consists of 12 faculties which are based in Silesian Region. Silesian University of Technology applies actively European standards for higher education. Silesian University of Technology builds up an active scientific co-operation with foreign centres, especially those from the European Union. Faculty of Chemistry and his Department of Physical Chemistry of Polymers is internationally recognized laboratory in the field of conducting polymer, their synthesis, doping and characterization. The researchers have interests and expertise which cover the following areas: synthesis of electronic conducting polymers, the physicochemical characterization of polymers, oligomers and composite materials, synthesis and characterization of new organic materials for optoelectronics and photovoltaics. The Lapkowski group has experience in international cooperation, including in the framework of European Commission programs. For instance, they are a partner in the BIOMOLEC number 247544FP-7 Peoples project, entitled *Functionalized biopolymers for application in molecular electronics and in photonics*. They are involved in Polish-Lithuanian Joint Research Project *Synthesis and electrochemical studies of organic electroactive materials*. They actively cooperate with Ecole Normale Superieure, Vavilov State Optical Institute, University of Sao Paulo at San Carlos, University of Strathclyde and Kaunas University of Technolog,.

UStrath - University of Strathclyde

University of Strathclyde has been awarded UK University of the year in the 2012 by the Times Higher Education. Department of Pure and Chemistry is also part of WestCHEM, the joint Research School of Chemistry (of the University of Strathclyde and Glasgow), was founded in 2005 as an internationally leading Research School in Chemical Sciences, delivering forefront chemistry research in state-of-the-art laboratories, and educating tomorrow's leaders through chemistry. The collaborative programme will train GSK staff at MPhil and PhD level, and the total number of students registered through this scheme is expected to reach more than 70 over the next two years. Based in Strathclyde and associated with both Chemistry Departments (Cronin, Littlejohn), the Centre of Continuous Manufacturing and Crystallisation (CMAC) has recently established a DTC with the remit to accelerate the adoption of continuous manufacturing processes, systems and plants for the production of high-value chemical products to higher quality, at lower cost and more sustainably. CMAC, which is one of nine centres funded through a UK-wide £51M EPSRC programme for Innovative Manufacturing, works closely with colleagues in. External non-EPSRC funding over the last 5 years has come from the Korea Institute for Advancement of Technology (KIAT) (ca. £1.5M Skabara, Ulijn, Dufton), ERC grants (Ulijn and Hevia, ca. £3M), Royal Society of Edinburgh Fellowships (Klett, Tuttle, Miras, Hill, Robertson, ca. £1.25M), Royal Society Fellowships (Forgan, Murray, ca. £1 M). Three Royal Society Wolfson Merit Awards have also been awarded (Mulvey, Cronin, Graham), and we have established a CDT with GlaxoSmithKline (£2M). The Departments have numerous partnerships with industrial collaborators and contribute strongly to both Universities' knowledge exchange programmes, which together boast one of the very strongest KTP portfolios in the UK. Strathclyde University has made a huge investment to establish a Technology and Innovation Centre (£89M) that will support research and knowledge exchange strongly linked with Chemistry. Glasgow University has been investing in a range of research initiatives including Solar Fuels, Synthetic Biology, and Sensor Systems as well as a new translational medical centre on the Garscube Campus (£25M). Bionanotechnology is one of the key themes in this and Prof Skabara is linked to the Centre through the Photonics theme, and this in turn is associated with the UK's first Fraunhofer Centre, which is based at Strathclyde. Prof. Skabara and Dr. Inigo has been recently awarded (£~900k) by KIAT for large scale production of light emitting organic materials for lighting and display technologies.

IPCP - Institute of Problems of Chemical Physics of the Russian Academy of Sciences

The Institute of Problems of Chemical Physics RAS is the founder of the research center of RAS in Chernogolovka and one of the largest and leading institutes of the Russian Academy of Sciences. The elementary processes are in the focus of scientists' attention: methods for calculation of the potential energy surfaces, transformation dynamics and cross-section of reactions, as well as semi-empirical methods for calculation of radical reactions have been developed. Successive applications of kinetic and chemical-physical approaches to the processes of polymerization and study of polymer properties resulted in determining the quantitative kinetic regularities and the mechanism of formation of various classes of polymers, the nature of active centers and creation of new initiators and inhibitors of the process. Multifrewuency EPR studies of free radicals, their accumulation and destruction, permeating radiation effects on chemical reactions, MW became the basis for a new field of science - chemistry of high energies. One of the major directions of the Institute activity has always been training of high-quality specialists. On the basis of the Institute there is a Branch of Moscow State University, a chair of Moscow Physical Technical Institute and other high schools. Many students of different high schools of Russia (former USSR) were professionally trained in the Institute: more than a thousand Ph.D. and doctoral theses were defended here. Specialists trained at the Institute work now not only in the Russian Academy of Sciences but in various high schools, research organizations, Russian Federation industry, in foreign countries. The Institute of Problems of Chemical Physics RAS builds up an active scientific co-operation with foreign centres, especially those from the European Union.

KnsUT - Kaunas University of Technology

Kaunas University of Technology (KnsUT) is the largest technical university in the Baltic States and the second largest institution of higher education of Lithuania. It contains 11 faculties, 11 research institutes and 5 research centres. Over 18,000 students are enrolled in studies including 500 Ph.D. students. The academic staff number is 1200. The Department of Organic Technology – Kaunas University of Technology (DOT-KTU) was established in 1922. It has 34 research staff (23 full time members and 11 PhD students) and is one of the most active research departments of Kaunas University of Technology. Since 2010, DOT-KTU staff published 60+ research articles that are listed in the ISI Web of Knowledge database. At present DOT-KTU's research interests focus on the synthesis and study of organic semiconductors; cationic (photo)polymerization of cyclic and vinyl ethers; chemical and physical modification of cellulose and other biopolymers; investigation of polyelectrolyte complexes and their application in environmental protection.

LvivPNU – Lviv Polytechnic National University

Lviv Polytechnic National University is the oldest technical educational institution in Ukraine and Eastern Europe. Lviv Polytechnic University consists of 15 educational and scientific institutes, as well as Institute of Distance Education, Institute of Postgraduate Education, Institute of Land Forces and Institute of Education, technical and techno-economic colleges, two high schools, 32 academic and laboratory buildings, 14 halls of residence, 3 recreational camps for students and teachers.

The "Organic Electronics Group" in the Electronics Devices Department carries out research in the following directions: search for constructive- technological solutions for the development of alternative power sources on the base of organic semiconductor structures; intercalate nanohybrids of inorganic/organic semiconductors; manufacturing and study of thin film organic phototransistors; development of methods of improving of efficiency of light emitting elements based on organic materials; investigation of physical-chemical properties of nanodementinal films of conductive polymers as sensitive layers of chemical recognition systems. Scientific research is focused on the development of phototransducers, solar cells, light-emitting devices and sensors on the base of nano-dimensional structures. Department has intensive cooperation with Kaunas University of Technology (Lithuania), Institute of Physics (Poland), Rzeszow University of Technology (Poland), Liquid Crystal Institute (USA), Institute of Physics of Microstructures (Russia). They are involved in Ukrainian – Russian international scientific project: *Manufacturing and study of thin film organic transistors* and Ukrainian – Lithuanian international scientific project: *Design of organic electroluminescence structure of blue and near ultraviolet spectral region*.

UoW - University of Wollongong

The Intelligent Polymer Research Institute (IPRI) is key research strength at the University of Wollongong and is the lead node of the Australian Research Council (ARC) Centre of Excellence for Electromaterials Science (ACES). Professor Gordon Wallace and his team at IPRI are recognised internationally as world leaders in the development of 'intelligent' materials and nanotechnology. Researchers work with

materials in the nano-domain (that is, with particles as small as one billionth of a millimetre) where electronic conductivity is vastly higher than in larger structures. IPRI is renowned for expertise in the electrochemistry of organic conductors; especially when those conductors are used in the applications of artificial muscles, photovoltaics, batteries, and biomedical applications.

GTech - Georgia Tech Research Corporation

The Bredas group is recognized world-wide as a leader in the theoretical description of electrically and optically active organic materials. The group focuses on computational materials chemistry, that is, they use computational methods as a tool to uncover the properties of novel organic materials and understand their chemistry and physics. They seek to derive an integrated understanding of the intrinsic molecular- and nano-scale processes in a variety of emerging applications in the fields of organic electronics, photonics, and information technology. To do so, they work on a daily basis in strong collaboration with synthetic chemists, physical chemists and physicists, and device engineers. Driven in particular by the goal to understand and develop innovative materials that lead to new ways to conserve energy (i.e., efficient solid-state lighting and low-power displays) and produce energy (i.e., solar cells), the Bredas group investigates the structural, electronic, and optical properties of novel, π-conjugated molecules and polymers. With a multidisciplinary approach that involves concepts and expertise from chemistry, physics, materials science and engineering, and computer science, the group employs and develops powerful theoretical techniques based on quantum mechanics, condensed-matter physics, and classical mechanics to accurately model the physico-chemical mechanisms that ultimately control the overall device efficiency.

Topics of interest include: Harnessing Solar Energy with Organic Photovoltaic Cells, Electroluminescence in Solid-State Lighting and Display Technologies, Nonlinear Optics for Photonics and Information Technology Applications, Interfacial and Surface Chemistry, Fundamental Insight of Electron Transport in Organic Electronic Applications, Mixed-Valence Organics: A Window into Fundamental Electron-Transfer Processes The Bredas group has extensive experience in international cooperation, including in the framework of European Commission programs. For instance, they were a partner for the EC project MINOTOR between 2009 and 2012. They are currently involved in a project funded by the German Society of Engineers involving several German institutions and Princeton University as well as in the "Center for Advanced Molecular Photovoltaics" funded by the King Abdullah University of Science and Technology in Saudi Arabia. They were in charge of the coordination of the “Solvay Global Discovery Program”, a program funded by the Belgian chemical company Solvay that run between Oct. 2008 and Dec. 2012; the program involved a team of 14 research groups from the Georgia Institute of Technology, the University of Washington, Princeton University, Imperial College London, and the Institute of Chemistry of the Chinese Academy of Sciences in Beijing.

B 1.3 Complementarities/synergies between the partners

The novelty of the undertaken research poses a set of challenges to be faced by the teams involved in the project. The participating teams have been recruited for the project with each respective Work Package in mind. Therefore, the knowledge and experience of each of the teams compliments those of the other groups, spanning the totality of the disciplines composing the project. This guarantees the success of the planned tasks, as every aspect of the research has been attributed to a sufficiently renowned expert.

The jigsaw puzzle of planned research has been solved in such a way that encountered challenges will be tackled by research efforts headed by a core of experienced researchers, specializing in the appropriate field along with the staff seconded to them. This enables the staff to gain experience in the areas of their scientific interest as well as to provide interdisciplinary insight to the research matters at hand. Such an approach is not only beneficial to training of the staff, it also provides synergy of knowledge and experience across the individual teams.

Synergy between the Work Packages will based upon the assesment and exchange of obtained data. This is best exemplified by the intented feedback loop from Work Packages 5 and 6 to Work Packages 1 and 2, where the data obtained from assembled devices will be used to verify the results of screening for the most promising monomers and oligomers, allowing to determine the most advantageous course of syntheses. Similar procedures have been created for synergy between other Work Packages.

Further synergy will be a result of meetings at international conferences, where the results obtained during the project will be presented. An additional advantage of this approach is that the experiences of project participants will be supplemented by those of other attendees at the conferences, indirectly drawing upon the intellectual resources of a wide group of researchers. In order to facilitate such gains, the participating teams

intend to apply for locally provided funding for the organisation of a number of conferences under the banner of the project itself.

B 2 Transfer of Knowledge

B 2.1 Quality and mutual benefit of the transfer of knowledge

According to the objectives of this project the methodology of transfer of knowledge programme exchanged between the partners will be focussed on the following types of activities:

- **Training through research**

  This module will be mainly devoted to train early stage researchers enrolled in Master and PhD programmes. The topics will be selected from the tasks collected in the work packages of this project, and will be continuously up-dated with new trends in the field, being also consistent with the research interest of PhD supervisors from both home and host institutions. Specific training activities will be detailed in research task lists delivered to each seconded scientist.

- **Join research**

  This activity is addressed to most of experienced researchers involved in the project and will contribute directly to enhance scientific collaboration between the participants in this project. Apart from the periods of exchanging staff, a continuous dialogue will be developed among the partners during the scientific events (table 5) arranged together for presentation or dissemination of joint scientific research results.

- **Sharing experience and transfer of know how**

  The exercised collaboration will be important for getting a new know how and learning new science, important for research. The GTech will input top world class quantum chemical expertise to the project training researchers in this field of science which they can later pursue at their home institutions. The input recieved from UStrath and SilUT will introduce new concepts of polymer chemistry especially that related to well defined polymer architectures. The UStrath and KnsUT will contribute advanced synthetic know how to their guest scientists. UStrath will also demonstrate the coordinated approach to synthesis and basic optoelectronic device testing seeking to learn knowledge of the latter from LvivPNU. SilUT will share and commit advanced experience as well as contribute to training through research of scientists from IPChPh and LvivPNU of in the field of advanced physicochemical characterisation of π-conjugated molecules including a suite of state-of-the art spectroelectrochemical and unique spectroscopic techniques strengthening their collaboration in this respect. IPChPh will deliver top-class Electron Paramagnetic Resonance spectroscopy and optical measurements experience which SilUT, UStrath and KnsUT will greatly appreciate for the advancement of research of doping mechanism of conjugated oligomers and polymers at their institutions. LvivPNU being an expert in electrochromic and electroluminescent device fabrication, optimisation and testing will greatly contribute to development of these practical research fields at UStrath and will certainly offer invaluable start on knowledge and experience to scientists from SilUT and KnsUT who pursue to commence this research topic on their home ground. LvivPNU will also present and address the problems of practical implementation of basic science results in a market economy environment. Last but not least the UoW partner will contribute knowledge of organic synthesis and spectroscopic characterisation in such areas as heterocycle synthesis and Raman spectroscopy of organic polymers while at the same time benefiting by uptake of experience of incoming staff in such fields as electrochemistry and *in-situ* spectroelectrochemistry.. From the above description it stands clear that the matrix of knowledge transfer benefits ties each project participant to at least two other project team partners, warranting efficient and productive transfer of knowledge and experience during implementation of the project and beyond.

- **Training in complementary skills**

  The complementary training will cover different science related aspects, and both theoretical and practical training will be provided. The different aspects that will be presented are of major interest for researchers at early stage of their careers.

- **Short stage training and developing communication skills**

  This activity will be achieved according to table 5. Eight scientific events are foreseen to be promoted by research team during the project period. Participation in these conferences and workshops will enable young scientists to contact the leading international scientists at these meetings. The workshops are addressed particularly to young researchers in order to allow them to better know each other. It is well known that the personal contacts are very helpful in developing good collaborations. The workshops and seminars will offer

them the opportunities to present and discuss results of their research activity. Presentation of results at an international conference will help the project participants to exchange ideas and views between them but will also offer them a chance of assesment of their achievements on the international scientific forum. It will help not only to achieve a good transfer of knowledge between third countries and EU countries but also to enrich the collaboration beyond the project framework. The events will have international audience and the European scientists' participation will be strongly encouraged.

Table 5 – Joint results dissemination opportunity events.

No.	Event	Venue	Year	Size of event
1	International Conference on Science and Technology of Synthetic Metals	Turku, Finland	2014 (annual)	large
2	The International Conference on Luminescence	Wroclaw, Poland	2014	medium
3	SPIE Photonics Europe 2014 | Photonics, Optics, Lasers, Micro- and Nanotechnologies	Brussels, Belgium	2014	Medium
4	8th International Conference on Nanostructured Polymers and Nanocomposites	Dresden, Germany	2014	medium
5	International Interdisciplinary Technical Conference of Young Scientists - InterTech	Poznan, Poland	2014 (annual)	local
6	The 11th International Symposium on Functional π-electron systems	To be announced	2014 (annual)	medium
7	66th Annual Meeting of the International Society of Electrochemistry	Taipei, Taiwan	2015 (annual)	Large
8	International Conference on the Physics of Optical Materials and Devices	To be announced	2015	medium

The project features research tasks carried out by a core of researchers, specializing in the appropriate field, along with a shell of seconded staff. Capitalizing on the training-through-research approach, this helps dissemination of knowledge and know-how across different research fields and teams. This system is designed with formation of master-students relationships between the teams for each of their respective research fields. The net effect is that each of the teams will gain understanding, and potentially deeper knowledge, about the research fields pursued by other teams.

In the field of conjugated materials, such an understanding is crucial, as it determines the potential for transforming innovative ideas and materials into practical applications. Therefore, what begins as teams of specialists in particular disciplines, will evolve into teams of interdisciplinary calibre, able to tackle the challenges of the process of implementing novel solutions, concerning electroactive materials and the devices based on them.

B 2.2 Adequacy and role of staff exchanged with respect to the transfer of knowledge

This international cooperation will open new possibilities to promote new direction for application of conjugated polymers and their use to develop new devices for optoelectronics. Partners with different specialization and scientific approaches will work together to advance the knowledge in the domain of conjugated polymers applied in new advanced materials.

Prof. Jean-Luc Bredas is a world authority in the area of theoretical chemistry, especially concerning issues of conjugated oligomers and polymers. Scientist visiting prof. Jean-Luc Bredas group (GTech) will therefore how modern quantum chemical calculation can help in design of functional materials. They will have an occasion of practising their skills in quantum chemical calculations using modern software and techniques, operating on high-performance computers.

Prof. Peter Skabara (UStrath) and his scientific group are known in science for their contributions in area of synthesis of conjugated monomers and polymers. Scientist visiting this group will learn how modern synthetic tools can be used in order to obtain prospective materials and how products of chemical reaction can be identified. Furthermore they will have an occasion of gaining experience in optoelectronic devices fabrication and characterization.

Polish group (SilUT) under the direction of prof. Mieczyslaw Lapkowski is well known in the world of science as a specialist in electrochemistry of conjugated polymers. Staff directed to this group will learn how electrochemical method help in research over optoelectronics materials. They will learn to use a variety of techniques (EPR, RAMAN, UV/Vis/NiR) in order to characterize materials.

Lithuanian group, directed by prof. Juozas Grazulevicius (KnsUT) are well known for their work in area of design and synthesis of electroactive compounds. Scientist visiting this group will learn how synthetic chemistry can be used in order to obtain new electroactive compounds. Furthermore scientist visiting this group will learn how new materials are analysed in term of

Russian group, under the leadership of dr Victor I. Krinichnyi (IPChPh) has enormous experience in field of characterising electroactive materials with EPR spectroscopy. Scientist visiting this group will learn how to use EPR in order to obtain data concerning charge carriers in examined compounds. They will have an occasion of learn how to maximize the potential of this certain spectroscopy.

Ukrainian group, under the leadership of prof. Pavlo Stakhira (LvivPNU) are well known specialist in field of optoelectronic devices construction. Scientist visiting this group will learn how to fabricate and characterise optoelectronic devices such as electroluminescent diodes and electrochromic devices.

Australian group, under the leadership of dr Pawel Wagner (UoW) is specialized in area of synthetic chemistry and application of conjugated compounds in optoelectronic devices. Scientist visiting this group will learn how to use modern synthetic tools, how to analyse obtained compounds in thin layers and finally how to construct optoelectronic devices.

Exchange of researchers proposed the project will provide an opportunity of comprehensive knowledge exchange. Scientist will learn how to use modern techniques, not present at their home universities, under the direction of scientist specialized in the particular field. Furthermore, it will give an occasion of creation of scientific network and strengthening already existing scientific cooperation. This is especially important, when taken into account young age of part of the exchanged staff. Young scientist will have a unique opportunity of development not only their practical skills, such as operation of modern apparatus, but will also benefit on their theoretical background. Contact with more experienced, foreign staff will result in intellectual development, which will in results in new research ideas of young scientist.

Realization of project will give the opportunity of learning how people work in different cultures and conditions. This will therefore result in obtaining experience in resolving non-standard problems, so often encountered in science. Especially it is worth noting that exchange of management team will create a possibility of learning how different management system work. Such experiences will lead to gain of abilities needed for even more efficient collaboration in future exchange programmes.

B 3 Implementation

B 3.1 Capacities (expertise/human resources/facilities/infrastructure) to achieve the objectives of the planned cooperation

B 3.1.1 Expertise and human resources

SilUT – Coordinator: Silesian University of Technology

Prof. Mieczyslaw Lapkowski is professor at Silesian University of Technology since 1991. His research interest covers the following areas: the fields of research activity are the synthesis of electronic conducting polymers, the physicochemical characterization of polymers, oligomers and composite materials, synthesis and characterization of new organic materials for optoelectronics and photovoltaics. He gained important expertise in the field of conductiong polymers by working in different research laboratories around the world, and particularly with the Nobel Prize winner in this field A. Heeger at Uniax company. He is author or co-author of 210 scientific publications, 4 books and 12 patents. He presented 18 invited papers and 80 communications at internationsal conferences. Prof. Lapkowski has also a good experience in managing research projects. He managed several project funded by Ministry of Science and Education of Poland and funded by National Science Fundation. For the excellence in scientific research he was awarded by the Cross of Merit, 1995, Award of Polish Chemical Society, 1991, Scientific Award of the Minister of Science and Higher Education in 1983,and in 1991.

Prof. Jerzy Zak is professor at Silesian University of Technology. His research interest covers: methods and application of electropolymerization processes, conducting polymers, polymer brushes; physical chemistry of

surface processes, AFM and STM microscopy. As a project representative he will advertise the results during lectures in Silesian University of Technology as well as other universities in Poland and throughout Europe. He will be responsible for surface research by scanning tunnelling microscopy and atomic force microscopy. These techniques will be used to describe quality of synthesised materials.

Domagala Wojciech Ph.D. - Researcher fellow of the Department of Physical Chemistry and Technology of Polymers. He has wide experience in the spectroelectrochemical ESR research of conjugated polymers. This person will be responsible for the analyze of doping processes using an ESR spectrometer coupled with UV-Vis-NIR spectrophotometer and a potentiostat, characterize the redox mechanism as well as intermediate and possible by-products of the process.

Turczyn Roman Ph.D. - Researcher has experience in the IR and Raman techniques. This person will be responsible for the analyze of vibrational spectra recorded during doping processes using Raman microscope coupled with potentiostat. Researcher will provide information about the structural changes occurring in conjugated polymer chain during doping processes.

Kuznik Wojciech Ph.D. – He has experience in the theoretical quantum-chemical analysis at the DFT level. He will perform theoretical calculations. He will compare the theoretical and experimental results.

Jedrysiak Rafal Ph.D. – Researcher fellow of the Department Of Organic Chemistry, Bioorganic Chemistry and Biotechnology. He has wide expertise in the designing and synthesis of new organic materials. He will synthesize the basic monomers.

Krzysztof Karon Ph.D. – Researcher fellow of the Department of Physical Chemistry and Technology of Polymers. He has expertise in the electrochemical and spectroelectrochemical research. He will be responsible for the fabrication of the thin solid films and electroluminescence measurement.

Ledwoń Przemyslaw, Tomasz Jarosz, Sandra Pluczyk, Katarzyna Krukiewicz, Katarzyna Piwowar, Kurowska Aleksandra, Brzeczek Alina – are Ph.D. students, the will perform spectral, electrochemical and spectroelectrochemical measurement.

UStrath - University of Strathclyde

Prof. Peter Skabara (Principal Investigator) group's main research theme at the University of Strathclyde is the synthesis and application of conjugated materials as organic semiconductors. Such activities involve the preparation and characterisation of heteroatomic molecular, oligomeric and polymeric materials (electron donors), as well as fluorene derivatives (electron acceptors or monodisperse oligomers). In addition to industrially sponsored support, sources of research income have included the Royal Society, NATO, EPSRC (GR/M36342, GR/R23053, GR/T28379, GR/M64130, EP/E027431, EP/E041337, EP/F05999X, EP/H004157, EP/I012591), European Commission and the Leverhulme Trust.During 2005-2006, Prof. Skabara was a Leverhulme Trust Research Fellow. The Fellowship enabled him to carry out research on the development of plastic batteries and electrochromic devices, complementing the ongoing activities in his research group. He has been a Visiting Research Fellow at UCLA (2006) and McGill University (2010). Prof Skabara was the Theme Coordinator for Materials and a member of the Scientific Organising Committee for IUPAC 2009 and co-Chair of MC9 (2009), a biennial Royal Society of Chemistry materials chemistry conference. He was a member of the Organising Committee for the 23rd International Congress on Heterocyclic Chemistry (Glasgow 2011), overseeing the organic materials component for this meeting. In 2014, Skabara will be Chair of the Faraday Discussion meeting on Plastic Electronics, to be held in Glasgow. Skabara is a member of the Editorial Board for Journal of Materials Chemistry and Associate Editor for the Beilstein Journal of Organic Chemistry. Over the last ten years, PJS has collaborated with device experts in applications such as solar cells (Samuel, St Andrews; Sariciftci, Linz), thin film transistors (MERCK Chemicals; Anthopoulos, ICL), OLEDs (CDT), hybrid LEDs (Dawson, Martin, Strathclyde; Humphreys, Cambridge), organic lasers (Dawson, Strathclyde; Turnbull, St Andrews; Bradley, ICL), electrogenerated chemiluminescence (Bard, Texas). He currently supervises twelve PhD students and three postdoctoral research assistants, whilst twelve postgraduate students have successfully completed their PhD studies under his supervision. To date, PJS has over 120 publications in the field of materials chemistry.

Dr. Jesuraj Inigo (Co-Investigator) joined the Pure and Applied Chemistry Department at the University of Strathclyde in 2011. Dr. Inigo has been working on organic electronic devices since his doctoral degree. He spent much of the time focused on chemical synthesis (during his PhD), chemical processing and characterisation of organic and polymeric devices for lighting and photovoltaics. He has utilised national synchrotron facilities such as the National Synchrotron Radiation Research Center (NSRRC), Taiwan and the Cornell High Energy Synchrotron Source (CHESS), USA, to determine the nano- and micro-structures of polymer devices. Dr. Inigo has represented Academia Sinica, Taiwan at various international conferences to promote its international PhD programme. He also successfully initiated collaborative programmes with Imperial College (London), Cornell University (USA), Frumkin Institute (Russia) during his stay at Academia Sinica,

Taiwan. This successful establishment of collaborations will be an added advantage for this project. Dr. Inigo has successfully contributed in delivering milestones funded by Carbon Trust and EoN.
Dr Neil Findlay (Researcher) joined the Department of Pure and Applied Chemistry in 2010 as a Research Fellow, working in the research group of Professor Peter Skabara on the synthesis of novel organic semiconductors for hybrid white lighting and display applications. Principally, Dr Findlay has designed and synthesised a family of monodisperse, fluorescent small molecules that, in collaboration with Professor Rob Martin (Strathclyde), have been employed as light converters for white light emission. Additionally, he has been involved in collaborations with research groups at the University of Edinburgh, University of St Andrews (both Scotland) and University of Victoria (Canada).

KnsUT - Kaunas University of Technology
Prof. Juozas Vidas Grazulevicius, habil. dr., professor, head of Department of Organic Technology, Kaunas University of Technology. He graduated from Kaunas Polytechnic Institute (present Kaunas University of Technology) Faculty of Chemical Technology in 1974. He defended doctoral thesis in 1980 and habilitation work in 1995 m. He is a full professor from 1996. He has spent extended periods at Heriot-Watt University Chemical Department (Edinburgh, Great Britain), Bayreuth University Department of Macromolecular Chemistry (Germany), Lancaster University, Center of Polymers (Great Britain), Cergy-Pontoise University (France) and the National University of Singapore. His main fields of interest are synthesis of organic semiconductors, polymerization and photopolymerization of cyclic monomers and vinyl ethers, photophysical properties of polymers. He has published more than 200 papers in international (referred in ISI) journals (1990-2013) among them five review articles. He is co-author of 5 chapters in books published by international publishers and more than 50 international patents. He was scientific supervisor of 16 doctoral students. He is a member of Lithuanian Academy of Sciences, a winner of Lithuanian National Science Prizes in 1997 and 2008.
Prof. Gintaras Buika, professor at the Department of Organic Technology, Kaunas University of Technology. He worked at Vilnius University Liquid Crystals Laboratory in 1984 – 1990 and from 1990 he is with Kaunas University of Technology Department of Organic Technology. He spent extended periods at Manchester (Great Britain) and Bayreuth (Germany) Universities, Institute of Polymer Chemistry of Poland Academy of Sciences. Main fields of interest: synthesis of polymers and investigation of their properties.
Prof. Saulius Grigalevicius, professor at the Department of Organic Technology of Kaunas University of Technology. The main field of interest is synthesis and investigation of organic compounds for optoelectronics. He published 76 papers and presented over 10 reports in scientific conferences. He obtained State grants for young scientists in 2002 and 2005, Academy of Sciences grant for young scientists, Humboldt foundation grant in 2003 m.
Dr. Jolita Ostrauskaite, assoc. professor at the Department of Organic Technology of Kaunas University of Technology. The main fields of her interest are synthesis and properties of electroactive monomeric and polymeric compounds for optoelectronics.
Dr. Ausra Tomkeviciene, research fellow of the Department of Organic Technology of Kaunas University of Technology. The main fields of her interest are design, synthesis and investigation of organic compounds for optoelectronics. She has published 25 scientific papers in the international journals and presented over 16 reports in scientific conferences.
Dr. Jūrate Simokaitiene, research fellow of the Department of Organic Technology of Kaunas University of Technology. The main fields of her interest are synthesis of electronically active polymers, synthesis of polymers, cationic photo induced polymerization, photo cross-linking.
Dr. Ramūnas Lygaitis, research fellow of the Department of Organic Technology of Kaunas University of Technology. The main field of interest is synthesis and investigation of semiconducting materials for organic electronics. He has published 26 papers and presented 10 reports in scientific conferences.
Dr. Asta Michaleviciute, research fellow of the Department of Organic Technology of Kaunas University of Technology. The main fields of her interest are design, synthesis and investigation of organic compounds for optoelectronics.
Jonas Keruckas, **Egles Stanislovaityte, Agne Ivanauskaite, Dalius Gudeika**, **Viktorija Mimaitė Raimonda Griniene**, **Monika Cekaviciute and Nadzeya Kukhta** are PhD students.

IPCP - Institute of Problems of Chemical Physics of the Russian Academy of Sciences
Victor I. Krinichnyi, the IPChPh team coordinator of this project, has an important experience in multifrequency EPR spectroscopy of condensed system, biological macromoleculs and conjugated polymers (world unique scientist who study different condjugated polymers i.e. polyaniline, polythiophene, polytetrathiafulvalene and their derivatives at various wavebands EPR) and organic devices preparation and characterization. At the 70th, he participated in the pioneer joint elaboration and creation at the Russian Institute

of Chemical Physics and Institute of Problems of Chemical Physics of the first multifunctional 2-mm (140 GHz) waveband EPR spectrometer with superconducting magnet allowed obtaining qualitative new information on various condensed systems. First exemplificative 2-mm waveband EPR studies of different organic and biological systems showed greatly efficiency of the method in the solving of various practical problems in physics, chemistry, molecular biology and interdisciplinary sciences. He received his higher education at the Kazan State University. His diploma "Microwave study of mechanism of molecular dynamics in liquids" was completed in the Moscow Institute of Chemical Physics under supervision of Prof. L.A. Blumenfeld and successfully defended at June 1975. His Ph.D. thesis "2-mm Waveband EPR spectroscopy as a method of the study of paramagnetic centers in biological and organic polymers" was completed with cooperation with laboratory of Prof. Y.S. Lebedev in the Moscow Institute of Chemical Physics and also was successfully defended by December 1986. After having obtained a Ph.D. in 1986 he was a scientific researcher at the Institute of Chemical Physics in Chernogolovka. From 1991 Dr. Krinichnyy is employed as a senior scientific researcher in the same Institute. He received Dr.Sci. Degree (Mathematics and Physics) in 1992. His Sci.D. Thesis (Habilitation) titled "High resolution 2-mm wave band EPR spectroscopy in the study of biological and conducting polymers. He have over 90 scientific publications including one monograph, three Chapters in edited books and 8 reviews where his original results are described. His publications are listed in Web of Science with h-factor of 14. He is an internationally recognized specialist in the magnetic resonance of spin-assisted charge separation and transfer in organic polymer photovoltaic cells for solar energy conversion.

Evgenia I. Yudanova has graduation at the Moscow State University (1977) , Ph.D. (Chemistry) at the Institute of Problems of Chemical Physics RAS (1983). Currently she is staff Senior Scientist of the Institute of Problems of Chemical Physics RAS. Has experience in the area of EPR spectroscopy of dynamical and structural properties of biological and organic systems. She has 59 publications in Russian and International journals.

Nikolai N. Denisov has graduation at the Moscow Physical Technical Institute (1985), Ph.D. (Chemistry) at the Institute of Problems of Chemical Physics RAS (1983). Currently he is staff Senior Scientist of the Institute of Problems of Chemical Physics RAS. Has experience in the area of pulse laser spectroscopy of organic solvents and films. He has 39 publications in Russian and International journals.

Natalia G. Spitsina has graduation at the Moscow State University (1974) , Ph.D. (Chemistry) at the Institute of Problems of Chemical Physics RAS (1981). Currently she is staff Senior Scientist of the Institute of Problems of Chemical Physics RAS. Has experience in the area of the synthesis of polymer (polyaniline, polyparaphenylrne, polyacetylene) and ion-radical-based molecular conductive systems. She has 61 publications in Russian and International journals.

Alexandre V. Kulikov has graduation at the Moscow State University (1968), Ph.D. (Mathematics and Physics) at the Institute of Problems of Chemical Physics RAS. Currently he is staff Leading Scientist of the Institute of Problems of Chemical Physics RAS. Has experience in the area of EPR spectroscopy of spin-labelled biological and organic solids. He has over 80 publications in Russian and International journals.

Victor R. Bogatyrenko has graduation at the Moscow State University (1973), Ph.D. (Biology) at the Institute of Problems of Chemical Physics RAS. Currently he is staff Senior Scientist of the Institute of Problems of Chemical Physics RAS. Has experience in the area of EPR spectroscopy of spin-labelled biological systems and organic polymers with spin charge carriers. He has over 30 publications in Russian and International journals.

Sergey V. Tokarev have graduate degree at Physics Faculty of the Kazan State University (2003). Currently he is staff Engineer of the Institute of Problems of Chemical Physics RAS. Have experience in high-field/high-frequency EPR spectroscopy of polymer and viscous systems modified with stable radicals. The results were published in 10 papers.

PhD student **Ksenia S. Kalinina** has graduation in Chemical Physics at the Saratov University (2011). Has experience in chemistry, with emphasis in Organic Chemistry. Working primarily in the following areas: conducting polymers, self-assembly, POEA, humic substances, organic compounds and water contaminants and environment

Valentina I. Trubochkina has graduate degree at the Electrostal medical technical secondary school (1957). Currently she is staff Senior Engineer of the Institute of Problems of Chemical Physics RAS. Has experience in chemical synthesis of high-weight molecular systems.

MSc student **Sergei S. Prigodin** have graduate degree at the Kazan State University (2012). Have experience in chemistry, with emphasis on the preparation and characterization of iodine doped conjugated polymers, acting mainly on: chronoamperometry, in InfraRed spectroscopy and scanning electron microscopy. Works with thin polymer films for photovoltaic devices.

LvivPNU –Lviv Polytechnic National University

Prof. Dr. Sc. Pavlo Stakhira, the LvivPNU team coordinator of this project. He is graduated at Ivan Franko State University in physics (1984), Ph.D. thesis at Lviv Polytechnic National University in solid state electronics

(1994) and Dc.Sc. thesis (2006) in technology of organic/inorganic electronic devices. He has an important experience in in study of solar panels (thin film, hybrid organic/inorganic heterojunction): fabrication, characterization and optimization of processes, the creation of organic light emitting diodes: development, characterization and optimization of processes, thin film semiconductor materials, and methods of deposition, characterization and analysis of: a) inorganic amorphous, polymorphic, nanocrystalline and microcrystalline thin film of porous silicon nanostructures, b)) organic (low-molecular and polymeric) film. He has an experience in managing, planning of experiments and conducting of joint researches.
Publications: 1 book (Nanoelectronics, in Ukrainian), more then 70 articles, 6 patents and more than 50 conference proceedings, where 35 of them are listed in Web of Science with h factor of 7.
Prof. Dr. Sc. Vladyslav Cherpak is graduated at Lviv Polytechnic National University (1997), did master (1999), Ph.D. thesis (2004) and Dc.Sc. thesis (2009) in technology of organic electronic devices. Has an experience in fabrication of electrochromic, organic photovoltaic and electroluminescence devices, and characterization of thin films of organic semiconductors. He published 43 papers, where 25 of them are listed in Web of Science with h factor of 6.
Prof. Dr. Sc. Zenon Hotra, has an experience in technology of micro- and nanostructures for integral optic elements and sensor of physical values.
Prof. Dr. Sc. Ivan Grygorchak has an experience in intercalate nanohybrid structure of non-organic/organic semiconductor configuration.
Dr. Dmytro Volyniuk is graduated at Lviv Polytechnic National University (2002), did master (2004), Ph.D. thesis (2008) in technology of electronic devices. He has experience in technology of OLED, with emphasis in multilayered efficient devices. He published 32 papers, where 20 of them are listed in Web of Science with h factor of 4.
Dr. Iryna Kremer is graduated at Lviv Polytechnic National University (2000), did master (2001), Ph.D. thesis (2007) in solid state electronics. She has experience in fabrication and characterization of organic electrochromic devices and organic sensors.
Dr. Mykhaylo Hladun is graduated at Lviv Polytechnic National University (1998), did master (2000), Ph.D. thesis (2004) in solid state electronics. He has experience in electronic devices simulation.
Lesya Voznyak, Natalia Kostiv, Marian Chapran have experience with electroluminescence devices.

UoW - University of Wollongong
Dr Pawel Wagner is a Senior Research Fellow within the IPRI. He has vast experience in design, synthesis and analysis of electroactive materials. His area of expertise covers organic and organometallic molecules and polymers for optoelectronics with the special focus on organic and hybrid solar cells. He is a co-author of more than 80 peer review publications.
Dr Klaudia Wagner is a Research Fellow within IPRI and Centre for Cooperative Research. She is an expert in electrochemical investigation of materials for electrooptics. She has extensive practical knowledge in building devices such as solar cells with focus on Dye Sensitised Solar Cells (DSSC).
Dr Sanjeev Gambhir is a senior research fellow within IPRI and Australian National Fabrication Facility (ANFF). His area of expertise covers organic synthetic chemistry, chemistry of carbon-based materials.
Mr Nick Roach has a BSc degree in Biochemistry. He has experience in organic synthetic chemistry and physicochemical investigations of molecular interactions.

GTech - Georgia Tech Research Corporation
The Bredas Research Group is composed of some 30 scientists including 5 Research Scientists, 12 Post-doctoral Researchers, 10 Ph.D. Students, and a couple of Visiting Fellows. Key personnel:
Jean-Luc Brédas received his Ph.D. in Chemistry in 1979 from the University of Namur, Belgium. After a postdoctoral stay at MIT (1980-1981), he went back to Namur as a Research Fellow of the Belgian National Science Foundation. In 1988, he was appointed Professor at the University of Mons-Hainaut, Belgium, where he established the Laboratory for Chemistry of Novel Materials. He joined the University of Arizona in 1999 before moving to the Georgia Institute of Technology in 2003. At Georgia Tech, he is Regents' Professor of Chemistry and Biochemistry and holds the Vasser-Woolley and Georgia Research Alliance Chair in Molecular Design. His research focuses on the computational design of novel organic materials. He is the author or co-author of over 900 peer-reviewed publications that have been cited over 42,000 times (excluding self-citations); his h-index has reached the 100 mark.
Veaceslav Coropceanu holds a Principal Research Scientist position at the Georgia Institute of Technology. His present research interests include the investigation of the electronic properties of organic and inorganic systems, electron and energy transfer phenomena at interfaces, and the theory of vibronic coupling.

Hong Li is a Senior Research Scientist at the Georgia Institute of Technology. She has been working on the electronic structure of organic and inorganic materials using a variety of computational quantum chemistry methods. Her current research interests include the study of metal/organic and inorganic/organic interfaces (for instance, self-assembled monolayers deposited on noble metals or conducting oxides) and the charge transport properties of organic molecular systems in both crystalline and amorphous structures.
Chad Risko holds a Senior Research Scientist position at the Georgia Institute of Technology. His research interests revolve around the description, using quantum chemistry and molecular dynamics methodologies, of complex organic systems including the structural, electronic, and optical properties of polymer or molecular blends relevant to organic photovoltaics.
Paul Winget is a Research Scientist at the Georgia Institute of Technology. He has extensive experience in a variety of computational quantum chemistry methods. His current research interests deal with the study of inorganic/organic interfaces, in particular those involving conducting oxides, and of organic light-emitting materials.

B 3.1.2 Facilities and infrastructure available

SilUT – Coordinator: Silesian University of Technology

Apparature at disposal of SilUT, to be used in this project: Potentiostats: Autolab PGSTAT20, Chemical Instruments 620A, 660C; UV-VIS Spectrophotometers: GBC Cintra-5, HITACHI U-3900: Fluorescence spectrophotometer: HITACHI F-2500; Electron Paramagnetic Resonance Spectrometer: JEOL; Infrared Spectrometer with Raman attachment: BIORAD; Atomic Force Microscope: Nanoscope; Scaning Tunneling Microscope: Nanoscope; Electrochemical Quartz Crystal Microbalance; Dynamic Electrochemical Impedance Spectrometer;

UStrath - University of Strathclyde

The facilities within the University of Strathclyde and the Department of Pure and Applied Chemistry are outstanding. The appointment of Professor Skabara to the University of Strathclyde in 2005 was supported by the creation of a new, purpose built laboratory for his group, consisting of thirteen large fume hoods for synthesis. The laboratory houses facilities which are specific to the project, including new, state-of-the-art electrochemical equipment and a robot-assisted microwave synthesiser. Facilities are also in place to study the spectroelectrochemistry of donor/acceptor species by cyclic voltammetry and UV-vis/near-IR, Raman and EPR spectroscopies. Due to the expansion of the Skabara research group, the team has acquired two further laboratories. Over the last year, the group has commissioned a device fabrication facility for OPVs, OFETs, OLEDs and sensors. Within the Department, a full suite of analytical techniques are available for organic materials analysis, including GPC, light scattering, DSC/TGA, surface analysis (AFM) and clean lab facilities. The Department of Chemistry in Strathclyde has an extensive range of state-of-the-art spectroscopic facilities for routine characterisation, including luminescence, mass spectrometry, nuclear magnetic resonance (one 600 MHz, one 500 MHz and two 400 MHz spectrometers are based in the host's Department), ultraviolet-visible, FT IR and Raman spectrometers, powder and single crystal diffractometers.

KnsUT - Kaunas University of Technology

Research facilities include gel permeation chromatography system (Malvern-Viscotec), luminescence spectrometer MPF-4 (Hitachi), UV-Vis spectrometer "Lambda 35" (Perkin Elmer), potentiostat-galvanostat "AutolabIII" (Autolab), IR spectrometer "Spectrum GX FT-IR System" (Perkin Elmer), HPLC chromatograph (Waters), automated flash chromatography system (Releveris), Proline Z 0,5 kN Materials Testing Machine (Zwick), viskosimeter "rheotec IIC", polarizing microscopy with heating plate "Olympus BX41", spectrometer DT-300 (Quantachrome), atomic absorption spectrometer, thermogravimetric analyzer "TGA 4000" (Perkin Elmer). DOT-KTU has access to nuclear magnetic resonance spectrometer (Varian Unity Inova, 300 MHz) and to the unique self made equipment for characterisation of organic semiconductors, i.e. time-of-flight equipment.

IPCP - Beneficiary: Institute of Problems of Chemical Physics of the Russian Academy of Sciences

The Institute of Problems of Chemical Physics RAS is the largest and leading institutes of the Russian Academy of Sciences. The Institute consists of 10 departments, 80 laboratories, some auxiliary sub-divisions including department of computing and information resources and multi-user analytical center which consists of the scientific complex, computing Center and technical complex computer networks and computer systems. The Departments of the Institute are equipped with novel devices with whom performs investigations in the following fields: general problems of chemical physics, structure of molecules and solids, kinetics and mechanisms of complex chemical reactions, chemical physics of explosion and combustion, chemical physics of

polymer synthesis and modification, chemical physics of biological processes and systems, chemical materials science. The total number of members of the Institute - 1092 people.
Apparature at disposal of IPChPh, to be used in this project: EPR spectrometer PS100X, Minsk University; EPR spectrometer SE/X 2544, Radiopan, Poland; Scanning microscope Zeiss LEO SUPRA 25, Germany; X-Ray INCA Energy analyser, Oxford Instruments; Chromatograph Waters 2414, USA; Scanning UV-3101PC spectrophotometer Shimadzu UV-VIS-NIR, Japan.

LvivPNU – Partner. Lviv Polytechnic National University

The laboratories at Lviv Polytechnic National University are equipped with all necessary facilities for the fabrication, investigations of electrophysical properties and applications of organic semiconductors, inluding, impedance spectroscopy, optical spectroscopy. Equipment that will be utilized by Ukrainian part of the team: Vacuum deposition chambers (Thermalevaporation), measurement system "AUTOLAB" supplied with "GPES i FRA" software. The Ukrainian part of the team also have access to other equipment that may be used in the project, including Cary 5000 UV-VIS-NIR spectrometers, Shimadzu UV-2450 spectrophotometer. During the project, Dual-channel System SourceMeter Keithley 2612A will be purchased by using finance from other sources. This purchase is justified since this piece of equipment is universal for many aspect of the proposed research and since this tool is essential for the ultimate success of the project.

UoW - University of Wollongong

The IPRI laboratories are fully equipped for whole spectrum of organic synthesis. Moreover the unit can offer: 500 MHz multinuclear NMR, MALDI, HPLC, MPLC, GC-MS, UV-vis, FTIR, Raman and emission spectroscopy, TGA, DSC, GPC, Zeta Nanosizer, Electrochemical Quartz Crystal Microbalance,AFM, SEM, drybox, wide range of potentiostats and fabrication facility for DSSCs.

GTech - Georgia Tech Research Corporation

Research in the Bredas group is enabled through both private and shared computing resources. The group owns a high-performance Linux cluster consisting of 576 AMD-2378 2.4-GHz processor cores, over 2.5 TB of aggregate memory, and more than 150 TB of disks divided among 72 compute nodes attached via high-speed gigabit and Infiniband interconnects. These nodes are integrated into a larger campus-level, high-performance computing (HPC) center, supported by a $10 million Institute investment in equipment, a 1,900 square-foot data center area, and a staff of full-time support personnel. Additionally, the Brédas group is one of four research groups comprising the Center for Computational Molecular Science and Technology (CCMST) at Georgia Tech. The principal CCMST computing resources consist of a recently purchased 32-node (720 2.0 GHz AMD-Opteron cores, 2.2 TB Memory, 108 TB of local disks) GPU cluster containing 32 NVidia Tesla GPUs as well as two smaller Linux clusters containing 77 nodes (154 3.2-GHz Intel Xeon processors, 338 GB memory, 12 TB of local disks) and 40 nodes (80 2.66 GHz Intel Xeon processors, 256 GB memory, 12 TB of local disks), respectively. As part of research grants from the US Department of Defense and Department of Energy, the group has also access to supercomputers at several national supercomputing resource centers.

B 3.2 Appropriateness of the plans for the overall management of the exchange programme

The overall management of the exchange programme (scientific co-ordination activities and technical management) will be managed through a Management Council (Table 7).

Table 6 Structure of Management Council

Coordination / Management	Person in charge
Project Coordinator	prof. Mieczyslaw Lapkowski (SilUT)
Scientific Coordinator	prof. Peter Skabara (UStrath)
Industry-academia transfer of know how	prof. Pavlo Stakhira (LvivPNU)
Education & Training Coordinator	prof. Jean-Luc Bredas (GTech)
Executive Monitoring	prof. Juozas Grazulevicius (KnsUT)
Financial Monitoring	dr Wojciech Domagala (SilUT)
Ethical & Gender Issues	dr Pawel Wagner (UoW)

Role of the Project Coordinator

The project coordinator prof. Mieczyslaw Lapkowski will oversee all visits within the project. The team leaders will inform him of their planned, or their team member, scientific visit to one of the partner laboratories. Depending on the arguments and based on the Management Council decision she will agree or not the proposed

visit. Important point will be obtaining agreement of the team leader of visited laboratory in order to organize it correctly. The communication will be done by e-mail. This is to be done in advance, defined by the team of visited laboratory, to ensure that the visit takes place in correct conditions.

Information Flow between Partners

In terms of communication, information flow between partners will be achieved via ordinary email correspondence, internet videophone conversations, meetings and reports. Project deliverables will be annexed to the relevant periodic or interim activity report submitted in conformity with the contract. The Coordinator will take part in meetings upon request of Commission's services.

Intellectual Property rights

All pre-existing know-how and intellectual property necessary for the execution of the project will be made available to any participant for the purpose of the project. Application of pre-existing know-how or other intellectual property generated during the course of the project will be protected and ownership will belong to the inventor or inventors involved (or their corresponding institutions as determined by existing employment and intellectual property contracts). Intellectual property and know-how generated during the course of the project will be made available to other participants as necessary for the completion of the project.

Support for detached and incoming personnel

For each detached or incoming person a task list will be drawn up at the host institution stipulating the training / scientific task to be fulfilled, appointing the responsible scientist in charge or the target fellow / group to be trained or to collaborate. The hosting team leader will arrange for a variety of support services to visiting personnel: full office, telephone, fax, library, computing facilities as well as all practical instructions regarding aspects of experimental work. Moreover appropriate conditions for housing of incoming staff are managed by the host, providing accommodation and facilities for free access to internet, meals, etc.

The framework of the proposal implementation is centered on the complementary involvement of each partner institution. The project features a complete research cycle for a number of molecules containing donor-acceptor systems. It begins with the design of the molecules and ends with an attempt to utilize them in prototype devices, possibly ready for implementation. The cycle is divided into individual stages with the very goal of achieving complementarity and synergy of the research efforts undertaken by all of the groups. The detailed scheme of the cycle is laid out in the Work Packages, and comprises the following:

1. Design and selection of promising donor-acceptor molecules.
2. Synthesis of selected, most promising compounds.
3. Comprehensive characterisation of the basic compounds and the products of their polymerization.
4. Study properties of thin layers of selected materials.
5. Construction of prototype electrochromic and electroluminescent devices.
6. Assessment of the results to refine the selection procedures.

Due to the unitary nature of the cycle, it is unequivocal that each and every one of the above tasks is complementary and necessary to the others. The results of every research stage are the basis for successive stages, each of them building up the added value of performed studies. The Work Packages have been designed in such a way, that Packages 3, 4 and 5 will feed back the results of their investigations to Packages 1 and 2. This allows for constant verification of the design and screening procedures used in Work Package 1 as well as to determine the most promising course of synthetic activities performed within Work Package 2. This not only allows to build upon the complementarity of each of the Work Packages, but pertains to an overall approach focused on maximizing synergy between individual research tasks, as well as between the Work Packages themselves.

B 4 Impact

B 4.1 Relevance of the proposed partnership to the area of collaboration and for the European Research Area[1]

Of all the potential applications of the materials that will be developed and studied in this project, diodes stand out as energy efficient transducers of electrical energy to light conversion. Besides other merits, they offer great potential to reduce carbon dioxide emission that accompanies the production of electricity using fossil

1 Towards a European Research Area, Brussels, 18 January 2000. COM (2000)6

fuels. Such fields of research are currently one of the top priority points of the European Union development policy.

According to the IDTechEx report in 2011 over 3,000 organizations are pursuing printed, organic, flexible electronics, including printing, electronics, materials and packaging companies. The market for printed and thin film electronics will be $2.2 Billion in 2011. 43% of that will be predominately organic electronics - such as OLED display modules. Of the total market in 2011, 38% will be printed. Initially photovoltaics, OLED and e-paper displays will grow rapidly, followed by thin film transistor circuits, sensors and batteries. By 2021 the market will be worth $44.25 billion, with 56% printed on solid and 43% on flexible substrates. The market potential of organic optoelectronic materials is hence rapidly developing and implementation of the proposed project will enable European research and development institutions to develop expertise needed to support the European market players with indispensable research and innovation potential.

The project supports and answers the European Union's recent concerns for the creation of a European Research Area and of durable development. The six EU laboratories participating to this project will gain experience and knowledge which will allow them to progress in this rapidly developing field of organic electronics in view of industrial applications. The very recent ambition expressed these days by the EU to be the world leading body in ICT will require development of new materials, new processing technologies and the training young scientists capable to do it. Commonly the 21st century is considered to be century of photonics. Development of new materials and of new knowledge will be necessary to be able to fulfil these ambitions. Moreover, the implications of the present project may be considered in the long term and with multiple impacts: educational, scientific, technical and economic. Indeed, this project is an example of active participation of chemists and physicists for the exploitation of ambipolar materials in topical device applications. The project also brings significant results from the point of view of the experience and of the knowledge gained toward sustainable development technologies in completing the greatest benefit: "clean" electrical energy in a "clean" environment.

The social impact is high, especially due to the participation of the educational sector by means of 6 universities. The results of the project will raise public awareness on clean technologies and renewable energy systems and will modify social attitudes towards them by intelligent dissemination. The training and implication of young researchers is a basic objective of the project, which will be successfully fulfilled. The project also brings opportunities for the universities and research institute to attract young Master and PhD students in developing and solving new research projects in both basic sciences and in advanced technologies.

All project academic partners have long-standing extensive experience in the training of researchers. This experience is relevant for the academic partners, where research and training of researchers is at the very core of their motto. Several of these partners have experience in previous European Research Projects and are also experienced organisers of international conferences and postgraduate training/education.

In the recent provisions of "European Research Area Vision 2020" is clearly stipulated that "by 2020, all actors fully benefit from the Fifth Freedom across the ERA: free circulation of researchers, knowledge and technology". In this context ERA defines the European way to excellence in research and as a major driver of European competitiveness in the globalised world, mainly based on the principle that modernization of research, education and innovation go hand in hand. As the result of this strategy, strong interactions within the "knowledge triangle": education – research – innovation, are promoted at all levels, from individual researchers, funding organizations, universities and research institutes, to SMEs and multinational companies and are supported by appropriate European mechanisms. All objectives of this project and all training/research activities reveal the high applicative potential targeted to transform the basic knowledge and excellence in research into a driving force of European competitiveness mainly in two thematic priorities: 5 – Energy, and 6 – Environment.

B 4.2 Potential to develop lasting collaboration with eligible Third Country partners, in particular in view of setting-up joint research projects

The project, as a multi-disciplinary research programme conducted across Europe and abroad, will have a long term impact by providing the next generation of experts with the necessary skills to face research and technological development in the field of organic electronics. The research needed to provide the training of researchers will facilitate a vertical integration of the different knowledge areas and it will also facilitate the horizontal application of technologies and skills across different fields of electronic applications. The career development plan will consolidate the training objectives, providing an outstanding opportunity for all researchers and excellent career prospects that will be of benefit for the whole community. The successful realisation of training and research objectives will result in considerable impact and benefits for Europe's Nanoscience & Nanotechnology sector and for its citizens.

Both Russia and Ukraine manifest very strong ambitions to develop new materials and new technologies for application in electronics and in photonics. The project will allow their scientists to gain new experience of collaboration with European laboratories. They are strongly interested not only in developing this collaboration, with mutual benefits, but also in reinforcing it in years to come. Collaboration with the U.S. and Australia is already well established and our project aims at taking advantage of this fact to increase the level of competence of the European institutions taking part in this undertaking and to establish long-term cooperation ties with institutions in these countries. The common benefit for all partners of this project will be the established cooperation with experienced partners in complementary fields of science, all of which will stimulate further multi-national project undertakings. This policy is officially supported by all governments of countries involved in this project. Finally it can be concluded that this IRSES project will provide attractive working conditions for researchers from all the seven institutions involved, both men and women in a balanced manner, in the framework of a single labour market which enables mobility between countries and sectors with minimal financial and administrative obstacles.

B 5 Ethics Issues

Research planned in the project targets the development of novel opto-functional materials for construction of consumable items such as displays, light sources and optical filters. It does not involve collection, processing or distribution of any sensitive material like personal data, animal or human tissue samples, genetic material, live animals, etc. For this reason, in spite of our necessarily positive answer to one of the questions of the Ethics Issues Table sheet, we foresee no ethical issues associated with project's conduct outside of the European Union.

ETHICS ISSUES TABLE

Areas Excluded From Funding Under FP7 *(Art. 6)*

(i) Research activity aiming at human cloning for reproductive purposes;

(ii) Research activity intended to modify the genetic heritage of human beings which could make such changes heritable (Research relating to cancer treatment of the gonads can be financed);

(iii) Research activities intended to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer;

All FP7 funded research shall comply with the relevant national, EU and international ethics-related rules and professional codes of conduct. Where necessary, the beneficiary(ies) shall provide the responsible Commission services with a written confirmation that it has received (a) favourable opinion(s) of the relevant ethics committee(s) and, if applicable, the regulatory approval(s) of the competent national or local authority(ies) in the country in which the research is to be carried out, before beginning any Commission approved research requiring such opinions or approvals. The copy of the official approval from the relevant national or local ethics committees must also be provided to the responsible Commission services.

Guidance notes on informed consent, dual use, animal welfare, data protection and cooperation with non-EU countries are available at :
http://cordis.europa.eu/fp7/ethics_en.html#ethics_sd

For real time updated information on Animal welfare also see:
http://ec.europa.eu/environment/chemicals/lab_animals/home_en.htm
For real time updated information on Data Protection also see: http://ec.europa.eu/justice/data-protection/index_en.htm

	Research on Human Embryo/ Foetus	YES	Page
	Does the proposed research involve human Embryos?		
	Does the proposed research involve human Foetal Tissues/ Cells?		
	Does the proposed research involve human Embryonic Stem Cells (hESCs)?		
	Does the proposed research on human Embryonic Stem Cells involve cells in culture?		
	Does the proposed research on Human Embryonic Stem Cells involve the derivation of cells from Embryos?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

	Research on Humans	YES	Page
	Does the proposed research involve children?		
	Does the proposed research involve patients?		
	Does the proposed research involve persons not able to give consent?		
	Does the proposed research involve adult healthy volunteers?		
	Does the proposed research involve Human genetic material?		

	Does the proposed research involve Human biological samples?		
	Does the proposed research involve Human data collection?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

	Privacy	YES	Page
	Does the proposed research involve processing of genetic information or personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?		
	Does the proposed research involve tracking the location or observation of people?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

	Research on Animals	YES	Page
	Does the proposed research involve research on animals?		
	Are those animals transgenic small laboratory animals?		
	Are those animals transgenic farm animals?		
	Are those animals non-human primates?		
	Are those animals cloned farm animals?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

	Research Involving non-EU Countries (ICPC Countries[2])	YES	Page
	Is the proposed research (or parts of it) going to take place in one or more of the ICPC Countries?	**X**	**32**
	Is any material used in the research (e.g. personal data, animal and/or human tissue samples, genetic material, live animals, etc) : a) Collected and processed in any of the ICPC countries?		
	b) Exported to any other country (including ICPC and EU Member States)?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL		

	Dual Use	YES	Page
	Research having direct military use		
	Research having the potential for terrorist abuse		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	X	

[2] In accordance with Article 12(1) of the Rules for Participation in FP7, 'International Cooperation Partner Country (ICPC) means a third country which the Commission classifies as a low-income (L), lower-middle-income (LM) or upper-middle-income (UM) country. Countries associated to the Seventh EC Framework Programme do not qualify as ICPC Countries and therefore do not appear in this list.

ENDPAGE

PEOPLE
MARIE CURIE ACTIONS

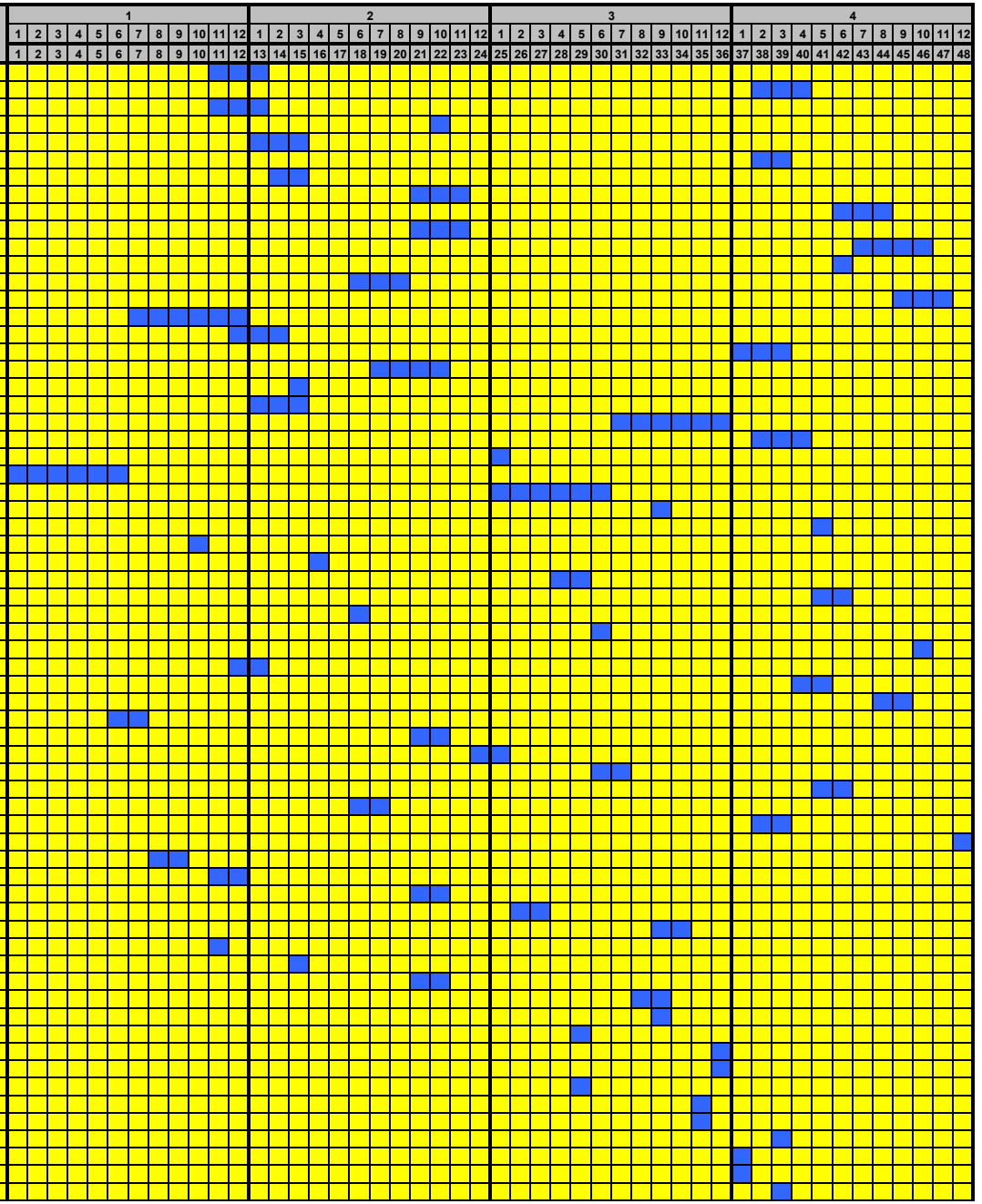
International Research Staff Exchange Scheme

Call: FP7-PEOPLE-2013-IRSES

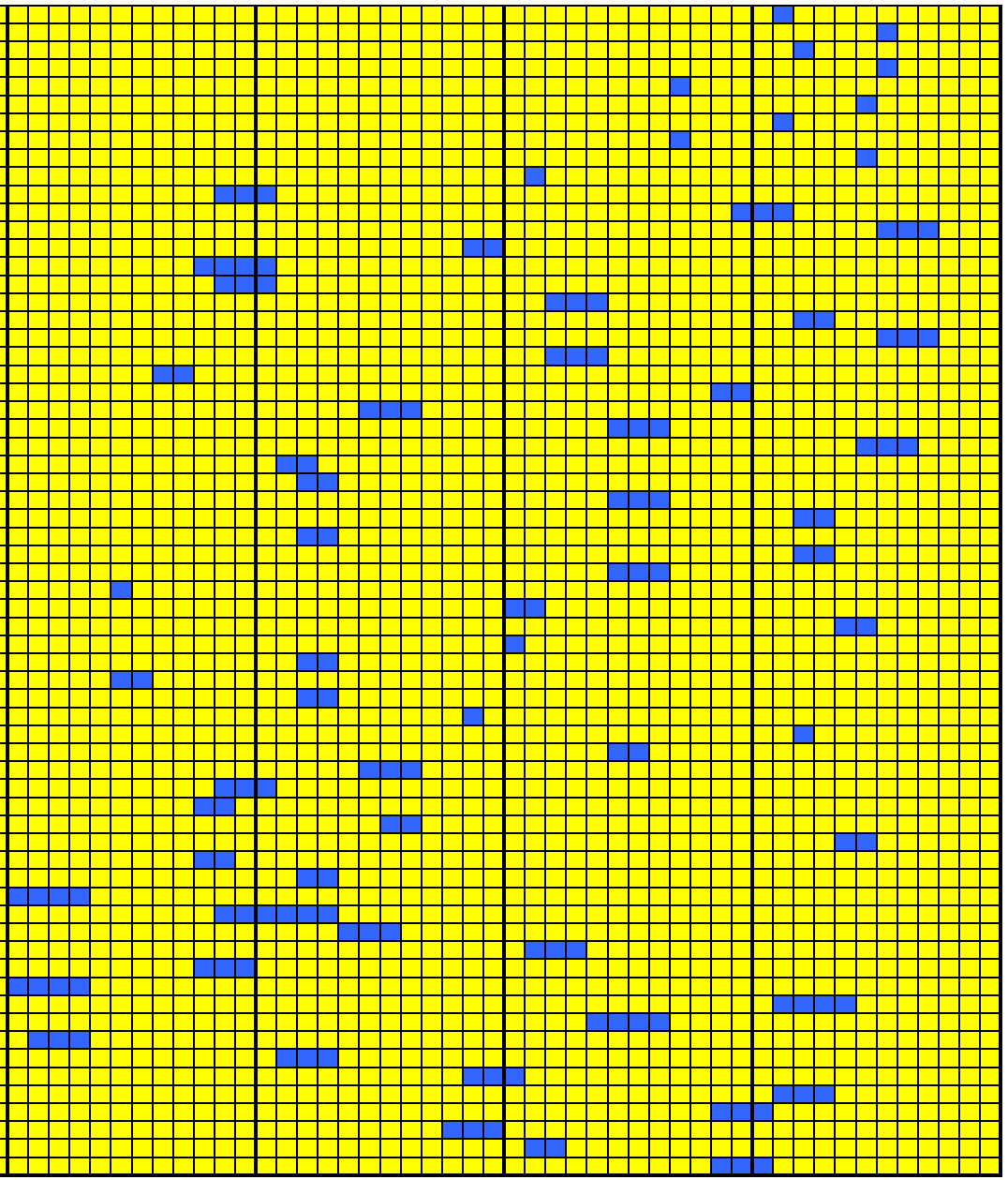
PART B

"AmbiPOD"

PARTICIPANT NUMBER	ORIGIN PARTNER	ORIGIN COUNTRY	HOST PARTNER	HOST COUNTRY	SECONDED TYPE	WORK PACKAGE	DURATION (MONTHS)	STARTING MONTH
1	SilUT	EU/AC	IPChPh	ICPC	ESR2	3	3	11
1	SilUT	EU/AC	IPChPh	ICPC	ESR6	4	3	38
1	SilUT	EU/AC	IPChPh	ICPC	ESR7	4	3	11
1	SilUT	EU/AC	IPChPh	ICPC	ER1	4	1	22
1	SilUT	EU/AC	IPChPh	ICPC	ER2	3	3	13
1	SilUT	EU/AC	IPChPh	ICPC	ER4	4	2	38
1	SilUT	EU/AC	IPChPh	ICPC	ER7	3,4	2	14
1	SilUT	EU/AC	LvivPNU	ICPC	ESR2	5	3	21
1	SilUT	EU/AC	LvivPNU	ICPC	ESR3	5	3	42
1	SilUT	EU/AC	LvivPNU	ICPC	ESR7	4	3	21
1	SilUT	EU/AC	LvivPNU	ICPC	ESR8	4,5	4	43
1	SilUT	EU/AC	LvivPNU	ICPC	ER1	5	1	42
1	SilUT	EU/AC	LvivPNU	ICPC	ER6	5	3	18
1	SilUT	EU/AC	LvivPNU	ICPC	ER7	5	3	45
1	SilUT	EU/AC	UoW	TC	ESR1	2	6	7
1	SilUT	EU/AC	UoW	TC	ESR3	3	3	12
1	SilUT	EU/AC	UoW	TC	ESR4	4	3	37
1	SilUT	EU/AC	UoW	TC	ESR5	5	4	19
1	SilUT	EU/AC	UoW	TC	ER1	3	1	15
1	SilUT	EU/AC	UoW	TC	ER2	4	3	13
1	SilUT	EU/AC	UoW	TC	ER3	2	6	31
1	SilUT	EU/AC	UoW	TC	ER6	4	3	38
1	SilUT	EU/AC	GTech	TC	ER1	1	1	25
1	SilUT	EU/AC	GTech	TC	ER5	1	6	1
1	SilUT	EU/AC	GTech	TC	ER5	1	6	25
2	UStrath	EU/AC	IPChPh	ICPC	ESR1	3	1	33
2	UStrath	EU/AC	IPChPh	ICPC	ESR2	3	1	41
2	UStrath	EU/AC	IPChPh	ICPC	ER1	3	1	10
2	UStrath	EU/AC	IPChPh	ICPC	ER2	3	1	16
2	UStrath	EU/AC	IPChPh	ICPC	ER3	3	2	28
2	UStrath	EU/AC	IPChPh	ICPC	ER4	3	2	41
2	UStrath	EU/AC	LvivPNU	ICPC	ESR1	4	1	18
2	UStrath	EU/AC	LvivPNU	ICPC	ESR2	4	1	30
2	UStrath	EU/AC	LvivPNU	ICPC	ESR3	4	1	46
2	UStrath	EU/AC	LvivPNU	ICPC	ER1	4	2	12
2	UStrath	EU/AC	LvivPNU	ICPC	ER2	4	2	40
2	UStrath	EU/AC	LvivPNU	ICPC	ER3	4	2	44
2	UStrath	EU/AC	UoW	TC	ESR1	5	2	6
2	UStrath	EU/AC	UoW	TC	ESR2	2	2	21
2	UStrath	EU/AC	UoW	TC	ESR3	3	2	24
2	UStrath	EU/AC	UoW	TC	ESR4	2	2	30
2	UStrath	EU/AC	UoW	TC	ESR5	3	2	41
2	UStrath	EU/AC	UoW	TC	ER1	5	2	18
2	UStrath	EU/AC	UoW	TC	ER2	3	2	38
2	UStrath	EU/AC	UoW	TC	ER3	2	2	48
2	UStrath	EU/AC	GTech	TC	ESR1	1	2	8
2	UStrath	EU/AC	GTech	TC	ESR2	1	2	11
2	UStrath	EU/AC	GTech	TC	ESR3	1	2	21
2	UStrath	EU/AC	GTech	TC	ESR4	1	2	26
2	UStrath	EU/AC	GTech	TC	ESR5	1	2	33
2	UStrath	EU/AC	GTech	TC	ER1	1	1	11
2	UStrath	EU/AC	GTech	TC	ER2	1	1	15
2	UStrath	EU/AC	GTech	TC	ER3	1	2	21
2	UStrath	EU/AC	GTech	TC	ER4	1	2	32
3	KnsUT	EU/AC	IPChPh	ICPC	ESR1	3	1	33
3	KnsUT	EU/AC	IPChPh	ICPC	ESR2	3,4	1	29
3	KnsUT	EU/AC	IPChPh	ICPC	ESR4	4	1	36
3	KnsUT	EU/AC	IPChPh	ICPC	ESR5	3	1	36
3	KnsUT	EU/AC	IPChPh	ICPC	ESR6	3	1	29
3	KnsUT	EU/AC	IPChPh	ICPC	ER1	3,4	1	35
3	KnsUT	EU/AC	IPChPh	ICPC	ER5	3	1	35
3	KnsUT	EU/AC	IPChPh	ICPC	ER7	3,4	1	39
3	KnsUT	EU/AC	IPChPh	ICPC	ER8	3	1	37
3	KnsUT	EU/AC	IPChPh	ICPC	ER9	3	1	37
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR1	4,5	1	39



3	KnsUT	EU/AC	LvivPNU	ICPC	ESR3	5	1	38
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR7	5	1	43
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR8	4,5	1	39
3	KnsUT	EU/AC	LvivPNU	ICPC	ESR9	5	1	43
3	KnsUT	EU/AC	LvivPNU	ICPC	ER2	5	1	33
3	KnsUT	EU/AC	LvivPNU	ICPC	ER3	4,5	1	42
3	KnsUT	EU/AC	LvivPNU	ICPC	ER4	5	1	38
3	KnsUT	EU/AC	LvivPNU	ICPC	ER6	4,5	1	33
3	KnsUT	EU/AC	LvivPNU	ICPC	ER7	5	1	42
3	KnsUT	EU/AC	UoW	TC	ESR3	3	1	26
4	IPChPh	ICPC	SilUT	EC/AC	ESR1	3,4	3	11
4	IPChPh	ICPC	SilUT	EC/AC	ESR2	3,4	3	36
4	IPChPh	ICPC	SilUT	EC/AC	ESR3	3	3	43
4	IPChPh	ICPC	SilUT	EC/AC	ESR4	4	2	23
4	IPChPh	ICPC	SilUT	EC/AC	ER1	3	4	10
4	IPChPh	ICPC	SilUT	EC/AC	ER2	3,4	3	11
4	IPChPh	ICPC	SilUT	EC/AC	ER3	4	3	27
4	IPChPh	ICPC	SilUT	EC/AC	ER4	4	2	39
4	IPChPh	ICPC	SilUT	EC/AC	ER5	3,4	3	43
4	IPChPh	ICPC	SilUT	EC/AC	ER6	3,4	3	27
4	IPChPh	ICPC	SilUT	EC/AC	ER7	3	2	8
4	IPChPh	ICPC	SilUT	EC/AC	ER8	3	2	35
4	IPChPh	ICPC	UStrath	EC/AC	ESR1	3,4	3	18
4	IPChPh	ICPC	UStrath	EC/AC	ESR2	3,4	3	30
4	IPChPh	ICPC	UStrath	EC/AC	ESR3	3	3	42
4	IPChPh	ICPC	UStrath	EC/AC	ESR4	4	2	14
4	IPChPh	ICPC	UStrath	EC/AC	ER1	3	2	15
4	IPChPh	ICPC	UStrath	EC/AC	ER2	3,4	3	30
4	IPChPh	ICPC	UStrath	EC/AC	ER3	4	2	39
4	IPChPh	ICPC	UStrath	EC/AC	ER4	4	2	15
4	IPChPh	ICPC	UStrath	EC/AC	ER5	3,4	2	39
4	IPChPh	ICPC	UStrath	EC/AC	ER6	3,4	3	30
4	IPChPh	ICPC	KnsUT	EC/AC	ESR1	3,4	1	6
4	IPChPh	ICPC	KnsUT	EC/AC	ESR2	3,4	2	25
4	IPChPh	ICPC	KnsUT	EC/AC	ESR3	3	2	41
4	IPChPh	ICPC	KnsUT	EC/AC	ESR4	4	1	25
4	IPChPh	ICPC	KnsUT	EC/AC	ER1	3	2	15
4	IPChPh	ICPC	KnsUT	EC/AC	ER2	3,4	2	6
4	IPChPh	ICPC	KnsUT	EC/AC	ER3	4	2	15
4	IPChPh	ICPC	KnsUT	EC/AC	ER4	4	1	23
4	IPChPh	ICPC	KnsUT	EC/AC	ER5	3,4	1	39
4	IPChPh	ICPC	KnsUT	EC/AC	ER6	3,4	2	30
5	LvivPNU	ICPC	SilUT	EC/AC	ESR4	5	3	18
5	LvivPNU	ICPC	SilUT	EC/AC	ESR6	3	3	11
5	LvivPNU	ICPC	SilUT	EC/AC	ER1	5	2	10
5	LvivPNU	ICPC	SilUT	EC/AC	ER1	5	2	19
5	LvivPNU	ICPC	SilUT	EC/AC	ER2	4	2	41
5	LvivPNU	ICPC	SilUT	EC/AC	ER3	5	2	10
5	LvivPNU	ICPC	SilUT	EC/AC	ER4	4	2	15
5	LvivPNU	ICPC	UStrath	EC/AC	ESR1	5	4	1
5	LvivPNU	ICPC	UStrath	EC/AC	ESR2	4	6	11
5	LvivPNU	ICPC	UStrath	EC/AC	ESR5	4	3	17
5	LvivPNU	ICPC	UStrath	EC/AC	ER2	1,5	3	26
5	LvivPNU	ICPC	UStrath	EC/AC	ER2	5	3	10
5	LvivPNU	ICPC	KnsUT	EC/AC	ESR3	4	4	1
5	LvivPNU	ICPC	KnsUT	EC/AC	ESR4	4	4	38
5	LvivPNU	ICPC	KnsUT	EC/AC	ESR5	5	4	29
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	2
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	14
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	23
5	LvivPNU	ICPC	KnsUT	EC/AC	ER1	4	3	38
5	LvivPNU	ICPC	KnsUT	EC/AC	ER2	4	3	35
5	LvivPNU	ICPC	KnsUT	EC/AC	ER2	5	3	22
5	LvivPNU	ICPC	KnsUT	EC/AC	ER3	5	2	26
5	LvivPNU	ICPC	KnsUT	EC/AC	ER4	4	3	35



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