

PROJECT FINAL REPORT

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1 Final publishable summary report

1.1 Executive Summary

The overall aim of the CEOSeR project is to build the research and innovation capacity at the Department of Organic Technology (the present title Department of Polymer Chemistry and Technology), Kaunas University of Technology (DOT-KTU), to the highest European level - in novel organic semiconducting materials and OLAE devices - and create a European Centre of Excellence in Organic Semiconductor Research.

Scientific expertise and facilities of DOT-KTU were further developed through a range of capacity building activities derived from SWOT analysis of DOT-KTU. The activities increased strength and visibility of DOT-KTU in the most advanced topics of organic technology:

- A) Electroactive low-molar-mass materials for OLAE technologies and
- B) Polymeric and dendritic materials for OLAE technologies.

One crucial component of CEOSeR project was represented by the twinning actions with five strategic research partners: Universitat Politècnica de Catalunya, Katholieke Universiteit Leuven, University of Cergy-Pontoise, Technische Universität Dresden and Novaled GmbH. These allowed the DOT-KTU research group to gain access and practical expertise with their state-of-the-art equipment and facilities.

CEOSeR project also gave DOT-KTU the opportunity to upgrade and acquire new state-of-the-art equipment. These combined with the scientific expertise gained as a result of the twinning actions allowed the DOT-KTU researchers to effectively approach scientific and technological topics situated at the forefront of organic semiconductor research. This highly increased scientific prestige of DOT-KTU. It is evident that such an organisation - endowed with state-of-the-art facilities, researchers possessing solid expertise, pursuing advanced scientific topics - became an attractive research environment. These factors facilitated another major component of this project, namely the reintegration of Lithuanian scientists working abroad in academic positions and in industry. This was also helpful in reducing the negative effects of the brain-drain.

The research topics approached in this project are at the forefront of scientific research and address a broad range of issues ranging from fundamental physics to organic chemistry. Scientific results were published in various journals and they were disseminated during various scientific events. All this contributed to the further improvement of the scientific environment in DOT-KTU, spurring new research ideas, and giving new opportunities of scientific collaboration with the twinning partners and other scientific groups in H2020 projects.

1.2 Summary description of project context and objectives

Aim

The overall aim of the CEOSeR project was to build the research and innovation capacity at the Department of Organic Technology (the present title Department of Polymer Chemistry and Technology), Kaunas University of Technology (DOT-KTU), to the highest European level - in novel organic semiconducting materials and OLAE devices - and create a European Centre of Excellence in Organic Semiconductor Research.

The Centre of Excellence were created by developing DOT-KTU's existing scientific expertise and research facilities and collaborating closely with the following specialist research groups: Universitat Politècnica de Catalunya (UPC), Katholieke Universiteit Leuven (KULeuven), University of Cergy-Pontoise (UCP-LLPI), Technische Universität Dresden (TU-Dresden) and Novalied GmbH (Novalied). Notably, the three founders of Novalied have been awarded with "Deutscher Zukunftspreis 2011" for Innovation and Technology by the Federal President Christian Wulff.

Twinning Partners



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 - Universitat Politècnica de Catalunya (UPC)
 - http://www.upc.edu/?set_language=en
- 

 - Katholieke Universiteit Leuven (KULeuven)
 - <http://www.kuleuven.be/english/>
- 

 - Université de Cergy-Pontoise (UCP-LLPI)
 - <http://www.u-cergy.fr/fr/index.html>
- 

 - Technische Universität Dresden (TU-Dresden)
 - <http://tu-dresden.de/en>
- 

 - Novalied AG
 - <http://www.novalied.com/>

Figure 1: Twinning partners in CEOSeR project

S&T Background and Objectives

World demand for energy is projected to more than double by 2050 and to more than triple by the end of the century. Incremental improvements in existing energy networks will not be adequate to supply this demand in a sustainable way. Finding sufficient supplies of clean energy for the future is one of society's most daunting challenges.

In this context, organic (opto)electronics is considered one of the most prospective technologies for saving energy. During the past 20 years, the number of publications about organic (opto)electronics has grown exponentially thus showing the increasing interest of researchers. Recent advances in organic optoelectronic and electronic devices - such as organic light-emitting diodes (OLEDs), organic photovoltaic devices (OPVs), and organic field effect transistors (OTFTs) - are driving the demand for new generation organic electroactive materials. However, further advances of these technologies rely substantially on the development of high-performance organic electroactive materials and an increased understanding of their chemical structure - property relationships. These important R&D needs have strongly influenced the two research topics chosen to focus on in this CEOSeR project:

Research Topic A: Electroactive low-molar-mass materials for OLAE technologies:

- A1 Electroactive molecular glasses for OLED and OPV applications
- A2 Low-molar-mass materials with increased molecular order and high charge mobilities for OFET applications

Research Topic B: Polymeric and dendritic materials for OLAE technologies:

- B1 Charge-transporting polymers and dendrimers for OPV and OFET applications
- B2 Photo-cross-linkable electroactive systems for OLED applications

In order for DOT-KTU to achieve the overall aim of establishing a European Centre of Excellence in Organic Semiconductor Research, the CEOSeR project was divided into six objectives, each one being implemented through its own Work Package. The close relationships between the Research Topics, Objectives and Work Packages are illustrated in the matrix below:

		CEOSeR Objectives					
		Develop DOT-KTU's Strategic Research Partnerships in ERA	Increase DOT-KTU's Human Potential	Increase DOT-KTU's Technology Potential	Increase DOT-KTU's Scientific Visibility	Increase DOT-KTU's Innovation Potential	Ensure DOT-KTU's Research Quality and Innovation Capability
CEOSeR Research Topics	Research Topic A A1. Electroactive molecular glasses for OLED and OPV applications. A2. Low-molar-mass materials with increased molecular order and high charge mobilities for OFET applications.	Work Package 1 - Know-How and Experience Exchange	Work Package 2 - Recruitment by DOT-KTU	Work Package 3 - Development and Upgrade of Research Equipment	Work Package 4 – Workshop, Conference, Dissemination and Promotion Activities	Work Package 5 - Elaboration of an Intellectual Property and Innovation Capacity Building Plan (IPI plan)	Work Package 6 – Ex-Post Evaluation
	Research Topic B B1. Charge-transporting polymers and dendrimers for OPV and OFET applications B2. Photo-cross-linkable electroactive systems for OLED applications						



Develop DOT-KTU's Strategic Research Partnerships

The objective was to exchange know-how and experience through twinning actions with 5 research centres:

- ❑ UPC which has strong expertise in development and a fabrication of organic solar cells. UPC also has strong background in the fabrication of field-effect transistors.
- ❑ KULeuven which has excellent knowledge of the development of new organic materials including organic semiconductors.
- ❑ UCP-LPPI has a considerable know-how in synthesis of smart interpenetrating polymer network (IPN)-based electronically active materials. The members of UCP-LPPI are recognized experts in the synthesis of conducting polymeric materials by electrochemical methods.
- ❑ TU-Dresden is one of the world's leaders in basic and applied research of organic semiconductors. Its expertise covers the whole range from the synthesis of small semiconducting molecules to the preparation and characterisation of optoelectronic devices such as OLEDs and OPVs.
- ❑ Novald which has first rate knowledge of the development of organic optoelectronic devices. It is a world leader in the OLED field and specializes in high efficiency long lifetime OLED structures.

Increase DOT-KTU's Human Potential

In the past, attracting and retaining top researchers has been a challenge for DOT-KTU due to the high salaries offered by industry. However, the CEOSeR project enabled DOT-KTU to offer competitive salaries and hire seven experienced researchers, one IP manager and two part-time Innovation Managers. Seven experienced researchers had expertise in one or more of the CEOSeR research topics: Research Topic A: Electroactive low-molar-mass materials for OLAE technologies and Research Topic B: Polymeric and dendritic materials for OLAE technologies.

Increase DOT-KTU's Technology Potential

The main objective was to develop DOT-KTU's existing R&D facilities. In order to achieve this, the equipment items that were upgraded or purchased include the following:

- Real time FTIR ATR spectrometer with UV light source (Research Topics B1, B2)
- Differential photocalorimeter (Photo DSC) (Research Topic A1, A2, B2)
- Liquid chromatography / Mass spectrometry (LC/MS) system (Research Topic A1, A2, B1, B2)
- Dielectric spectrometer (Research Topic B1, B2)
- Thermogravimetry analyser (Research Topic A1, A2, B1, B2)
- Photoelectron spectrometry setup (Research Topic A1, A2, B1, B2)
- Microwave synthesis system (Research Topic A1, A2)
- Laboratory glove box (Research Topic A1, A2, B2)
- Small laboratory equipment and chemicals (Research Topic A1, A2, B1, B2)
- Semi-micro balances with 0.01 mg readability (Research Topic A1, A2, B1, B2)
- Drop shape analysis system (Research Topic A1, A2, B1, B2)
- Charge mobility measurement setup (Research Topics A1, A2, B1, B2)
- Fluorescence Spectrometer (Steady State, Lifetime, Phosphorescence) (Research Topics A1, B2)
- OLED characterization setup (Research Topics A1, B2)

- Thermal (resistive) evaporation system (Thermal (resistive) evaporation system)
- Chemical crystallography instrument (small molecule X-ray diffractometer) (Research Topics A1, A2, B1, B2)

The additional units for installed equipment listed above were purchased:

- Diode laser for the luminescence spectrometer
- UV detector for UPLC system
- Cryostat for the luminescence spectrometer
- Gaussian software

Increase DOT-KTU's Scientific Visibility

The objective was to maximise the dissemination and promotion of the CEOSeR project and DOT-KTU in Lithuania and across the EU. A multilateral approach was adopted to achieve this: (i) promotion of project activities and results through a project website; (ii) publication of a market research report on R&D opportunities for DOT-KTU; (iii) publication of research results in peer reviewed journal and presentation at international conferences; (iv) publication and syndication of S&T features aimed at "layman audiences"; (v) organisation of dissemination workshops with the regional electronics and chemical sector; and (vi) organisation of international scientific conferences at DOT-KTU.

Increase DOT-KTU's Innovation Potential

The objective was to elaborate a strategic Intellectual Property development plan for CEOSeR, in order to manage and protect its IP as well as build its innovation capacity. The plan provided a framework for improvement of IP and protection of know-how. Meanwhile, the innovation capacity building measures assured IP and innovation management training and updated of competences, provided expertise on IP issues and assured organisation of the IP including networking with partnering entities for co-exploitation of results.

Ensure DOT-KTU's Research Quality and Capability

The objective was to ex-post evaluate the performance of DOT-KTU in terms of its innovation orientation, international position, scientific/academic position, education and governance system, in order to ensure its research quality and innovation capability beyond the CEOSeR project. The ex-post evaluation was conducted by four international, independent experts nominated by the Commission who constitute the CEOSeR Evaluation Board. The experts were chosen from academia and industry with a range of knowledge and experience in top-level research in organic semiconductors.

1.3 Description of the main S&T results/foregrounds

1.3.1 Overview

The project CEOSeR was divided into seven work packages:

- WP1:** Know-How and Experience Exchange
- WP2:** Recruitment by DOT-KTU
- WP3:** Development and Upgrade of Research Equipment
- WP4:** Workshop, Conference, Dissemination and Promotion Activities
- WP5:** Elaborate a Strategic Intellectual Property Development Plan
- WP6:** Ex-Post Evaluation
- WP7:** Project Management

Each work package played an important and precise role and significantly contributed to the scientific advancement of DOT-KTU. All CEOSeR activities were concentrated around R&D concerning organic semiconductors as depicted in the Figure 2 (see below). Work packages 1, 2 and 3 contributed directly to improving the research capacity of the centre by supporting and mobilising the human and material resources, and by developing strategic twinning partnerships with excellent research groups. Work package 4 was mainly focussed on dissemination of scientific information. Work package 5 elaborated an Intellectual Property and Innovation Capacity Building Plan (IPI Plan). Meanwhile, Work package 6 ex-post evaluated the performance of DOT-KTU, in order to ensure its research quality and innovation capability beyond the CEOSeR project.

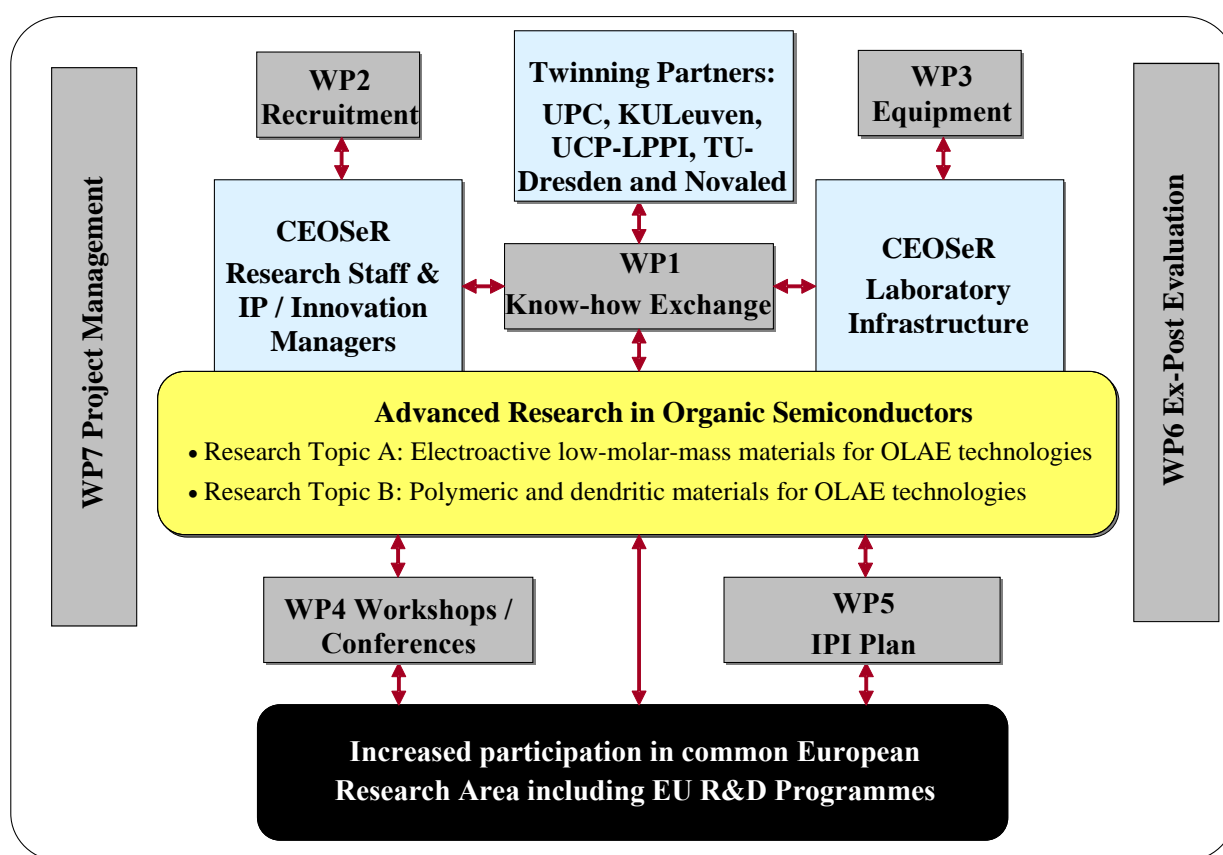


Figure 2: CEOSeR project activities (from DoW)

In the following pages, the main achievements of the project are reported with a brief description of main activities. Further details are reported in the referenced deliverable documents. Deliverables and milestone description are also reported.

1.3.2 WP1: Know-How and Experience Exchange

Via the CEOSeR project, the DOT-KTU researchers gained “know-how” and experience in specific areas which included synthesis of new electroactive functional materials; preparation and manipulation of materials into different condensed phases; characterization of their properties; investigation of charge transport mechanisms and correlation with the molecular structures and morphology; and application of the developed materials in optoelectronics.



WP 1 was divided into ten tasks related to the work:

- Development of the twinning activities and twinning schedule
- Twinning with UPC
- Twinning with KULeuven
- Twinning action with UCP-LPPI
- Twinning action with TU-Dresden
- Twinning action with Novaled
- Research training periods
- Common lab organization
- Common journal and conferences papers
- Prepare European research proposals

Development of the twinning activities and twinning schedule

All the planned twinning activities of the researchers from DOT-KTU to the laboratories of the twinning partners were implemented. The research training periods in the laboratories of the twinning partners and at DOT-KTU for young MSc and PhD students were organized. The details of the twinning visits and training periods were presented and discussed at the Steering Committee meeting of the project on 09-11 May 2016 in Trakai (Lithuania). The forecasted and fulfilled visits and trainings are captured in the two tables below.

DOT-KTU visits to twinning partners

	Year 1 (01/02/2013 – 31/01/2014)		Year 2 (01/02/2014 – 31/01/2015)		Year 3 (01/02/2015 – 31/07/2016)		Forecast Total Person- months	Total Person- months
Task 1.2 (UPC)	R. Lygaitis (1PM)		A. Tomkevičienė (1PM) J. Simokaitienė (1PM)		J. Simokaitiene (2PM)		5.5	5
Task 1.3 (KULeuven)	A. Bučinskas (3PM) D. Gudeika (3PM)		J. Keruckas (4.5PM)		-		15.5	10.5
Task 1.4 (UCP-LPPI)	J. Simokaitienė (2PM)		J. Simokaitienė (4PM) V. Mimaite (3PM) A. Tomkevičienė (2PM)		V. Mimaite (2PM) M. Cekaviciute (2PM)		11.5	15
Task 1.5 (TU- Dresden)	N. Kukhta (5PM)*		R. Lygaitis (6PM)		R. Lygaitis (6PM) A. Tomkeviciene (5PM)		15	22
Task 1.6 (Novaled)	A. Tomkevičienė (6PM)		-				12	6
Task 1.7 (Training for MSs/PhD students)	UPC	V. Mimaite (1PM)	UPC	R. Butkute (1PM)	UPC	J. Songaila (1PM) R. Butkute (1PM)	17.5	18.5
	TU- Dresden	T. Matulaitis (5PM)*	KULeuven	R. Laurinavičiūtė (4.5PM)	KULeuven	G. Simkus (2.5PM) Y. Danyliv (2.5PM)		
Total Person- Months	26		27		24		77	77

The visits of twinning partners to DOT-KTU

	Year 1 (01/02/2013 – 31/01/2014)	Year 2 (01/02/2014 – 31/01/2015)	Year 3 (01/02/2015 – 31/07/2016)	Forecast Total Person- months	Total Person- months
Task 1.2 (UPC)	J. Puigdollers (0.5PM) C. Voz (0.5PM)	J. Puigdollers (0.25PM)	J. Puigdollers (0.5PM) C. Voz (0.5PM)	2	2.25
Task 1.3 (KULeuven)	W. Dehaen (0.5PM) M. Vlasselaer (0.25PM)	M. Vlasselaer (0.25PM)	W. Dehaen (0.75PM) K. Karypidou (1PM) M. Vlasselaer (0.25PM)	2	3.0
Task 1.4 (UCP-LPPI)	G. Sini (0.5PM)	G. Sini (0.25PM) F. Goubard (0.25PM)	G. Sini (0.25PM) P.H. Aubert (0.25PM)	2	1.5
Task 1.5 (TU-Dresden)	H. Froeb (0.25PM)	H. Froeb (0.25PM)	H. Froeb (0.5PM)	2	1
Task 1.6 (Novaled)	-	-	J. Scholz (0.25PM)	2	0.25
Total	2.5	1.25	4.25	10	8

Twinning with UPC

- Development of scientific knowledge and skills in the preparation of OPV and OTFT devices.
- Practice of OPV and OTFT preparation.
- Training in device characteristics analyses and chemical structure-efficiency relationship.



V. Mimaite, Dr. R. Lygaitis and Dr. J. Puigdollers in the laboratories of Polytechnic University of Catalonia (Barcelona, Spain).



Dr. A. Tomkeviciene, Dr. J. Simokaitiene, R. Butkute, W. Boukehili and Dr. J. Puigdollers in the laboratories of Polytechnic University of Catalonia (Barcelona, Spain).

Twinning with KULeuven

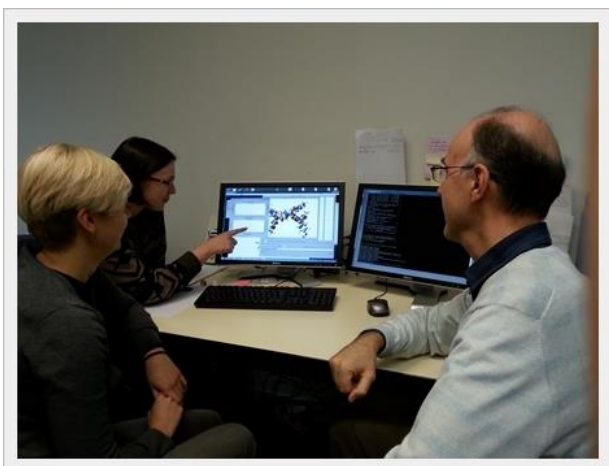
Training in the synthesis of new organic semiconductors by new synthetic methods such as inter- and intramolecular cycloadditions, palladium-catalyzed coupling reactions etc.

- synthesis of bis(dialkoxyphenyl)sulfane building-blocks
- synthesis of new carbazole and aromatic diketone derivatives
- synthesis of substituted indole derivatives

Training in characterisation of the chemical structures of the new synthesized compounds by the newest equipment of nuclear magnetic resonance (NMR), mass spectrometry (MS), and Fourier-transform infrared (FT-IR) spectroscopy.

Twinning action with UCP-LPPI

- Optimization of the geometry of the designed molecules.
- Study of the Density Functional Theory (DFT) calculations employing the B3LYP functional with the Gaussian 09 program.
- Training in the Time-Dependent DFT (TD-DFT) method for the calculation of absorption spectra and excitation energies S1 (single state energy), T1 (triplet state energy), hole-transfer rate constants, and electronic couplings between HOMO (LUMO) orbitals.

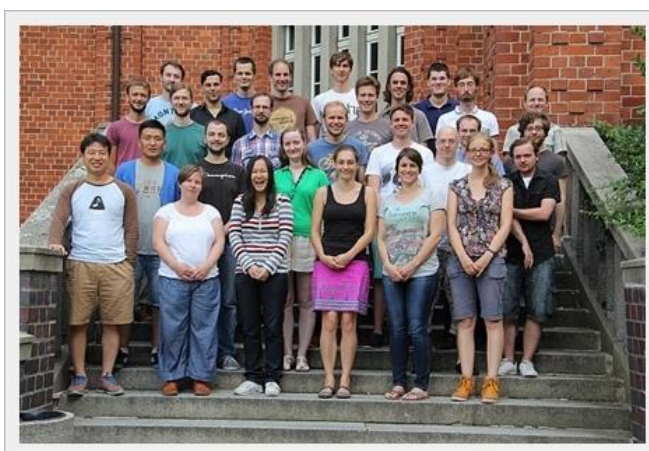


Discussion between Dr. J. Simokaitiene, V. Mimaite and G. Sini on quantum chemical computational methods (University of Cergy-Pontoise).

Twinning action with TU-Dresden

- Design of new molecules for the OLED and OPV applications.
- Optimization of the geometry of the designed molecules.
- Experience in the synthesis of emitting and OPV materials.
- Experience in photophysical characterization of the synthesized compounds.

Dr. Ramunas Lygaitis spent 1 year joining Organic light emitting group in Institut für Angewandte Photophysik (Technische Universität Dresden, Germany).





Twinning action with Novaled

- Experience in the synthesis of p-dopands.
- Learning in the production chain from materials synthesized in the chemistry lab to OLED or OTFT devices.
- Training in OLED making and testing facilities.

All of this took place in an industrial environment, with specific differences to a University environment in terms of pressure, repeatability, purity and safety.

Research training periods

Training periods were organized for PhD and MSc students of DOT-KTU in the laboratories of twinning partners during all project period. CEOSeR supported:



- three visits (3PM) of PhD students and one visit (1PM) of MSc student from DOT-KTU to UPC for training in characterisation of electroactive materials and preparation of OPV devices;
- two visits (7PM) of PhD students and one visit (2.5PM) of MSc student from DOT-KTU to KULeuven for training in the synthesis of new organic semiconductors by new synthetic methods.
- one visit (5PM) of PhD student from DOT-KTU to TU-Dresden for training in photophysical characterization of organic semiconductors, determination of the photoluminescence quantum yield of emitting materials.

Common lab organization



A common research space was created with the strategic twinning partners where the researchers worked together as a single research unit.

Common journal and conferences papers

The relevant results were published in common journal and conference papers which are listed below:

Twinning Partners	Publications and patents
	A. Tomkeviciene, L.G. Gerling, S. Mahato, C. Voz, J. Puigdollers, J. V. Grazulevicius, New triindole derivatives for efficient organic photovoltaic cells, under preparation. J. Simokaitiene, L.G. Gerling, C. Voz, J. Puigdollers, J. V. Grazulevicius, Bridged-Triphenylamines with Extended π -Conjugated Systems as Efficient Donor Organic Semiconductors for Organic Photovoltaic Applications, under preparation. J. Simokaitiene, L.G. Gerling, S. Mahato, C. Voz, J. Puigdollers, J. V. Grazulevicius, Studies on the Potential Donor Properties of Diphenylethenyl-Substituted Bridged-Triphenylamines in Organic Solar Cells // Baltic Polymer Symposium 2015, September 16-18, Sigulda, Latvia : programme and book of abstracts, p. 40.
	A. Buciskas, D. Waghay, G. Bagdziunas, J. Thomas, J.V. Grazulevicius, W. Dehaen, Synthesis, Functionalization, and Optical Properties of Chiral Carbazole-Based Diaza[6]helicenes, <i>Journal of Organic Chemistry</i> 2015, 80(5), 2521-2528. G. Simkus, M. Vlasselaer, W. Dehaen, J.V. Grazulevicius, Conventional synthesis and properties of carbazole-based helicenes, under preparation. R. Keruckiene, W. Dehaen, J.V. Grazulevicius, Nitro substituted indolylcarbazole derivatives: electrochemical and photophysical properties and computational studies, under preparation.



Twinning Partners	Publications and patents
	<p>D. Peckus, R. Laurinavičiūtė, T. Tamulevičius, J. Simokaitienė, S. Tamulevičius, J.V. Gražulevičius, M. Daniels, W. Dehaen, Dynamic optical properties of electroactive arylamines with carbazole units // <i>Advanced materials and technologies : book of abstracts of the 17-th international conference-school, 27-31 August 2015, Palanga, Lithuania.</i></p> <p>R. Keruckienė, D. Peckus, T. Tamulevičius, J. Simokaitienė, S. Tamulevičius, J.V. Gražulevičius, M. Daniels, W. Dehaen. Nitro substituted indoly carbazole derivatives: electrochemical and photophysical properties and computational studies // <i>Electronic Processes in Organic and Inorganic Materials (ICEPOM-10), 23-27 May 2015, Ternopil, Ukraine.</i></p>
	<p>V. Mimaite, J.V. Grazulevicius, R. Laurinaviciute, D. Volyniuk, V. Jankauskas, G. Sini, Can Hydrogen Bonds Improve the Hole-Mobility in Amorphous Organic Semiconductors? Experimental and Theoretical Insights, <i>Journal of Materials Chemistry C</i>, 3 (2015) 11660-11674.</p> <p>A. Tomkeviciene, J.V. Grazulevicius, D. Volyniuk, V. Jankauskas, G. Sini, Structure-Properties Relationship of Carbazole and Fluorene Hybrid Trimers: Experimental and Theoretical Approaches, <i>Physical Chemistry Chemical Physics</i> 2014, 16, 13932-13942.</p> <p>A. Tomkeviciene, J. Sutaite, D. Volyniuk, N. Kostiv, G. Simkus, V. Mimaite, J.V. Grazulevicius, Aggregation-Induced Emission Enhancement in Charge-Transporting Derivatives of Carbazole and Tetra(tri)phenylethylene, <i>Dyes & Pigments</i>, submitted.</p> <p>J. Simokaitiene, L.G. Gerling, C. Voz, J. Puigdollers, J. V. Grazulevicius, Bridged-Triphenylamines with Extended π-Conjugated Systems as Efficient Donor Organic Semiconductors for Organic Photovoltaic Applications, under preparation.</p> <p>A. Tomkeviciene, J. Sutaite, J.V. Grazulevicius, New Carbazole Derivatives Containing Tri- and Tetraphenylethylene Groups for Optoelectronics // International Conference of on Pure and Applied Chemistry, June 23-27, 2014, Mauritius.</p> <p>A. Tomkeviciene, J. Sutaite, D. Volyniuk, J.V. Gražulevičius, Organic light emitting diodes combining electroluminescence from both monomeric and exciplex excitons based on aggregation-enhances-emission-active derivatives of carbazole and tetra(tri)phenylethylene // 2015 International Chemical Congress of Pacific Basin Societies, December 15-20, 2015, Honolulu, Hawaii.</p> <p>J. Simokaitiene, L.G. Gerling, S. Mahato, C. Voz, J. Puigdollers, J. V. Grazulevicius, Studies on the Potential Donor Properties of Diphenylethynyl-Substituted Bridged-Triphenylamines in Organic Solar Cells // Baltic Polymer Symposium 2015, September 16-18, Sigulda, Latvia : programme and book of abstracts, p. 40.</p>
	<p>N.A. Kukhta, O. Zeika, J. Widmer, C. Koerner, R. Meerheim, A. Petrich, N.-R. Behrnd, K. Leo, J.V. Grazulevicius, New Electron Transport Materials for High Performance Organic Solar Cells: Synthesis and Properties of Symmetrical and Asymmetrical 1,4,5,8-Naphthalenetetracarboxylic Dianhydride Derivatives, <i>Advanced Electronic Materials</i> 2016, 2, 1600047.</p> <p>L. Fanga, F. Holzmueller, T. Matulaitis, A. Baasner, C. Hauenstein, J. Benduhn, M. Schwarze, A. Petrich, F. Piersimoni, R. Scholz, O. Zeika, C. Koerner, D. Neher, K. Vandewal, K. Leo, Thermally Stable Fluorene-Containing Low-Energy Gap Organic Dyes with Low Voltage Losses for Organic Solar Cells, under preparation.</p>



Twinning Partners	Publications and patents
	T. Matulaitis, L. Fanga, O. Zeika, C. Körner, K. Leo, F. Holzmüller, K. Vandewal, German Patent No DE102014217817A1 (2016). R. Lygaitis, <i>et al</i> German Patent application P58672 (2015). R. Lygaitis, O. Zeika, R. Scholz, P. Kleine, F. Wüst, M. Oberländer, S. Hofmann, J.V. Gražulevičius, K. Leo, S. Reineke, Synthesis and characterization of the new emitters for OLED applications // 2015 International Chemical Congress of Pacific Basin Societies, December 15-20, 2015, Honolulu, Hawaii.

Prepared European research proposals

- ❑ DOT-KTU organised the seminar for know-how exchange with the twinning partners Novalad and TU-Dresden (29 – 31 January, 2014). During the seminar, DOT-KTU discussed with the partners preparation of the joint research and innovation proposal “*New paradigms for high efficiency blue emitters for white OLEDs*” (PHEBE) for submission to the call ICT 29 - OLED Lighting of the Horizon 2020 programme. The PHEBE proposal was highly evaluated. The project started on 1 February 2015.
- ❑ DOT-KTU prepared with 9 partners in the spring of 2014 a Marie Curie Initial Training Network proposal “*Donor-Acceptor light emitting exciplexes as materials for easily to tailor ultra-efficient OLED lighting*”. The proposal scored 88% but was not selected for funding.
- ❑ The joint Marie Curie Initial Training Network proposal “*Donor-Acceptor light emitting exciplexes as materials for easily to tailor ultra-efficient OLED lighting*” (EXCILIGHT) was prepared for submission for the call H2020-MSCA-ITN-2015. The EXCILIGHT proposal was highly evaluated. The project started on 1 September 2015.

Results Achieved

Deliverable No	Due Date	Actual Date	Deliverable Description
D1.1	M18	M18	Interim Report on Twinning
D1.2	M40	M40	Final Report on Twinning

1.3.3 WP2: Recruitment by DOT-KTU

It is the aim to recruit returning experienced Lithuanian researchers in order to support the project and reduce brain-drain.

The work was divided into two tasks:

- Recruitment of Experienced Researchers
- Hiring and Evaluation

Recruitment of Experienced Researchers

The recruitments were performed through open competitions. Job adverts were placed on CEOSer project website and on EURAXESS website. The precise strategy for recruiting experienced researchers, IP manager and innovation manager was defined by the CEOSer coordinator together with DOT-KTU’s human resource department.

DOT-KTU recruited seven experienced Lithuanian or international researchers (**150 person-months**) corresponding to the CEOSer research topics as follows:

- 2 experienced researchers having experience in the synthesis and characterization of organic low-molar-mass semiconductors (Research Topic A1);



- 1 researcher with extensive experience in the synthesis and characterization of ordered (e.g. liquid crystalline) organic semiconductors (Research Topic A2);
- 2 experienced researchers with expertise in the synthesis and characterization of polymeric semiconductors (Research Topic B1);
- 1 experienced researcher with expertise in the preparation and characterization of cross-linkable organic semiconductors (Research Topic B2);
- 1 experienced researcher with expertise in investigation of photophysical and photoelectrical properties of organic semiconductors and in preparation of (opto)electronic devices (Research Topics A1, A2, B1, B2).

Several of the hired researchers continue their activity in DOT-KTU, supported by new projects that they have developed/won.

As it was planned, DOT-KTU recruited one IP manager who had experience of IP management in a research organisation, significant experience in training researchers in IP issues, strong experience of technology-transfer, and good knowledge of public schemes for exploiting IPR in Lithuania and the EU. The appointed IP manager was employed by the project for 30 person-months.

Two part-time innovation managers who had a strong R&D background in chemistry, physics or microelectronics, strong experience in innovation management techniques and training people to use them, significant project management experience with national and international ICT and NMP R&D projects, and a significant record of preparing successful ICT and NMP R&D proposals for national and international projects were hired by DOT-KTU. The appointed innovation managers were employed by the project for 30 person-months (6 months part time position (0.75) + 21 months part time position (0.5)).

Hiring and Evaluation

DOT-KTU assessed every 12 months the progress made by the appointed experienced researchers, by the IP manager and by the innovation managers. Based on their performance it was decided whether to continue with their contracts.

Results Achieved

Deliverable No	Due Date	Actual Date	Deliverable Description
D2.1	M18	M18	Interim Report on Recruitment
D2.2	M36	M36	Final Report on Recruitment

1.3.4 WP3: Development and Upgrading of Research Equipment

This work package had the main objective to reinforce the material S&T potential by upgrading DOT-KTU existing facilities dedicated to the scientific topics of this project, by purchasing and installing new scientific and technological equipment and also by training personnel for the efficient use of the new equipment. This work package is essential for the rapid development of DOT-KTU into a European Centre of Excellence in Organic Semiconductor Research. The list of the purchased and installed equipment is listed in section 1.2.

WP 3 was divided into four tasks related to the work:

- Market and supplier analysis for the equipment
- Announcement of call to tender to purchase equipment according to national and European laws (on a specialized website)

- Selection, negotiation and contracting
- Installing, training and exploitation

Market and supplier analysis for the equipment

The market and supplier analyses for each part of equipment were completed. In most cases, at least three local and foreign suppliers were asked for quotes and specifications. In the cases of some specialised equipment, two suppliers were contacted.

Announcement of call to tender to purchase equipment according to national and European laws

The two announcements of call to tender were placed on specialized website CVP IS (<https://pirkimai.eviesiejipirkimai.lt/>) on 2013-02-01 (the tender number is 132149) and on 2013-05-24 (the tender number is 137646). In addition, the announcements were published on the newsletter "Valstybės žinios" No. 10 and 42.

Selection, negotiation and contracting

According to the national laws, the following winners of the tender No. 132149 were announced: UAB Analytical Solutions, UAB Labochema, UAB Armgate and UAB Bruker Baltic OU. For the tender No. 137646 the following winners were announced: UAB Expertus Vilnensis, UAB Vildoma, UAB Energenas, UAB Laisva Linija. For the tender No. 169489 the following winners were announced: UAB Expertus Vilnensis, UAB Vildoma, UAB Analytical solution. Contracts were signed with all of these suppliers.

Installing, training and exploitation

All the new equipment purchased were installed. DOT-KTU researchers have received training on how to use the new equipment and the equipment are now exploited.

Results Achieved

Deliverable No	Due Date	Actual Date	Deliverable Description
D3.1	M18	M18	Interim Report on Development and Upgrading of Research Equipment
D3.2	M40	M40	Final Report on Development and Upgrading of Research Equipment

1.3.5 WP4: Workshop, Conference, Dissemination and Promotion Activities

The aim of this Work Package is to maximise the dissemination and promotion of the CEOSer project and DOT-KTU in Lithuania and across the EU.

WP 4 was divided into five tasks related to the work:

- Project website development, operation and maintenance
- Publicity and promotion
- Dissemination workshops with the regional electronics and chemical sector
- International scientific conference at DOT-KTU
- Participation of the members of DOT-KTU at the international scientific conferences

Project website development, operation and maintenance

The website has been created and it was regularly updated with news and events

<http://ceoser.ktu.lt/>



Publicity and promotion

An integrated approach was adopted to maximising the publicity and promotion of the project results and activities of the CEOSeR project in Lithuania and across EU. The approach included:

- Publication of a market research report to help DOT-KTU to target R&D opportunities in organic semiconductor R&D services over the next 5 years.
- Publication of research results in peer reviewed journal and presentation at international conferences.

The relevant results were published in 15 journals and 70 conference papers:

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7. R. Lygaitis, B. Schmaltz, R. Degutyte, J.V. Grazulevicius, M. Degbia, F. Tran Van, P. Strohmriegl, V. Jankauskas, J. Boucle, Star-shaped triphenylamine-based molecular glass for solid state dye sensitized solar cell application, *Synthetic Metals* 2014, 195, 328-334. DOI: 10.1016/j.synthmet.2014.06.024. <http://www.sciencedirect.com/science/article/pii/S037967791400229X>

8. R. R. Reghu, J. Simokaitiene, J. V. Grazulevicius, S. Raisys, K. Kazlauskas, S. Jursenas, V. Jankauskas, A. Reina, Synthesis and properties of hole-transporting triphenylamine-derived dendritic compounds. *Dyes and Pigments* 2015, 115, 135-142. DOI: 10.1016/j.dyepig.2014.12.013.
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15. A. Tomkeviciene, J. Sutaite, D. Volyniuk, N. Kostiv, G. Simkus, V. Mimaite, J.V. Grazulevicius, Aggregation-Induced Emission Enhancement in Charge-Transporting Derivatives of Carbazole and Tetra(tri)phenylethylene, *Dyes & Pigments*, submitted.

The conference papers:

1. D. Volyniuk, V.V. Cherpak, P.Y. Stakhira, B.F. Minaev, G.V. Baryshnikov, M.M. Chapran, A. Tomkeviciene, J. Keruckas, J.V. Grazulevicius, Highly Efficient Blue OLEDs Based on Delayed Fluorescence Phenomenon // Inter-Continental Advanced Materials for Photonics Summer School I-CAMP•13, June 26 – July 6, 2013, Cambridge, United Kingdom.
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6. Juozas V. Grazulevicius, Conducting Polymers and Molecular Glasses for Optoelectronic Applications // Nanostructures for Sensing & Energy Conversion (NaSEC'14), March 17-19, 2014, Algiers, Algeria : book of abstracts, p. 10.
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14. J.V. Grazulevicius, Ambipolar Polymers and Molecular Glasses for Optoelectronic Devices // Baltic Polymer Symposium 2014, 24-26 September, Laulasmaa, Estonia : 2014, programme and book of abstracts, p. 20.

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Dissemination workshops with the regional electronics and chemical sector

- ❑ Three dissemination workshops with regional and chemical sector companies as Labochema, Biotechna, Linea Libera and Bioeksma were organised during the International Conference of Lithuanian Chemical Society "Chemistry and Chemical Technology 2014", "Chemistry and Chemical Technology 2015", "Chemistry and Chemical Technology 2016".
- ❑ The DOT KTU dissemination workshop with one of the leading European companies in organic electronics Novald GmbH (Germany), including scientists from Dresden University of Technology (Germany) and Durham University (UK) was held on 30 January 2014 Location: Room 103, Institut für Angewandte Photophysik (IAPP), George-Bähr-Str. 1, 01069 Dresden.
- ❑ Three dissemination workshops with the leading European companies in organic electronics Novald GmbH (Germany) and Astron-FIAMM (France), including scientists from Dresden University of Technology (Germany) and Durham University (UK) were held:
 - Date: 03-04 February 2015, Location: Novald GmbH, Tatzberg 49, 01307 Dresden, Germany.
 - Date: 09 July 2015, Location: the Palatine Centre Durham University Stockton Road, DH1 3LE Durham, United Kingdom.

- Date: 23 February 2016, Location: Institut für Angewandte Photophysik (IAPP), George-Bähr-Str. 1, 01069 Dresden, Germany.

International scientific conference at DOT-KTU

- ❑ The first international conference of the project „Baltic Polymer Symposium 2013“ was held in Trakai, Lithuania, during the 18 – 21 of September, 2013.
- ❑ The second international conference of the project „Baltic Polymer Symposium 2014“ was held in Laulasmaa, Estonia, during the 24 – 26 of September, 2014.
- ❑ The third international conference of the project „Baltic Polymer Symposium 2015“ was held in Sigulda, Latvia, during the 16 – 18 of September, 2015.

Participation of the members of DOT-KTU at the international scientific conferences

The members of DOT-KTU attended 24 international scientific conferences, compared to 9 planned for the project:

2013

1. **Inter-Continental Advanced Materials for Photonics Summer School I-CAMP•13**, June 26 - July 6, 2013, Cambridge, United Kingdom.
2. **International Conference on Advanced Polymeric Materials**, October 11-13, 2013, Kottayam, Kerala, India.
3. **2nd Central and Eastern European Conference on Thermal Analysis and Calorimetry**, August 27-30, 2013, Vilnius, Lithuania.
4. **Baltic Polymer Symposium 2013**, September 18-21, 2013, Trakai, Lithuania.

2014

5. **Nanostructures for Sensing & Energy Conversion**, March 17-19, 2014, Algiers, Algeria.
6. **International Conference of on Pure and Applied Chemistry**, June 23-27, 2014, Mauritius.
7. **15th International Krutyn summer school 2014 “Challenges to open up the new era of organic photonics and electronics from material to market - from Asian perspective”**, June 8-14, 2014, Krutyn, Poland.
8. **International Conference on Organic Synthesis “Balticum Organicum Syntheticum”**, July 6-9, 2014, Vilnius, Lithuania.
9. **Baltic Polymer Symposium 2014** September 24-26, 2014, Laulasmaa, Estonia.
10. **3rd European Symposium of Photopolymer Science**, September 9-12, 2014, Vienna, Austria.

2015

11. **EMN Photovoltaics Meeting (Energy Materials Nanotechnology)**, January 12-15, 2015, Oelando FL, USA.
12. **International Convention on Colorants (COC 15)**, March 3-4, 2015, Mumbai, India.
13. **European Training School and Conference on Organic Photovoltaic Stability** June 4-12, 2015, Cargese, France.
14. **4th International Caucasian Symposium on Polymers and Advanced Materials**, July 1-4, 2015, Batumi, Georgia.
15. **Technology Transfer Skills Development Summer School**, June 29-July 03, 2015, Heraklion, Greece
16. **Advanced Materials and Technologies 2015**, August 27-31, 2015, Palanga, Lithuania.
17. **13th European Conference on Molecular Electronics (ECME)**, September 1-5, 2015, Strasbourg, France.

18. **Baltic Polymer Symposium 2015**, September 16-18, 2015, Sigulda, Latvia.
19. **Technology Transfer Skills Training Course**, October 5-9, 2015, Bologna/Milan, Italy.
20. **13th European Short Course on Time-resolved Fluorescence Spectroscopy**, November 2-5, 2015, Berlin, Germany.
21. **2015 International Chemical Congress of Pacific Basin Societies**, December 15-20, 2015, Honolulu, Hawaii.

2016

22. **EMN Meeting on Polymer (Energy Materials Nanotechnology)**, January 12-15, 2016, Hong Kong, China.
23. **Electronic Processes in Organic and Inorganic Materials (ICEPOM-10)**, May 23-27, 2016, Ternopil, Ukraine.
24. **XIXth International Krutyn Summer School 2016 „Aggregation-Induced Emission (AIE): Phenomenon, Principle and Application“**, May 15-21, 2016, Krutyn, Poland.

Results Achieved

Deliverable No	Due Date	Actual Date	Deliverable Description
D4.1	M3	M2	CEOSeR project website
D4.2	M18	M18	Interm Report on Conferences and Workshops
D4.3	M40	M40	Fianl Report on Conferences and Workshops
D4.4	M18	M18	Market Research Report

Milestone No	Due Date	Actual Date	Deliverable Description
MS1	M3	M3	Completed CEOSeR Website

1.3.6 WP5: Elaborate a Strategic Intellectual Property Development Plan

The aim of this Work Package was to develop an Intellectual Property and Innovation Capacity Building Plan (IPI Plan) for DOT-KTU, which takes into account the CEOSeR project's scientific domain, i.e, organic semiconductor research, as well as existing IP know-how and innovation capacity of DOT-KTU.

The work was divided into two tasks:

- IP capacity building measures
- Innovation capacity building measures

IP capacity building measures

Institutional level measures (KTU):

- Defining what constitutes an ideal patent portfolio for DOT-KTU;
- Using the PCT Information Service in order to evaluate the merits of internationalising current and future patents of DOT-KTU;
- Creating a work plan that outlines the critical milestones for operationalizing the strategy;
- Monitoring regularly performance of DOT-KTU against the plans for implementing its strategic IP development plan.

Departmental level measures (DOT-KTU):

A series of seminars and training courses on IP issues for KTU/DOT-KTU staff were held:



- New opportunities for the protection of inventions in Lithuania and Europe;
- Introduction to Patent literature searching and analysis;
- Intellectual property protection measures;
- Intellectual Property (IP) Valuation and Technology Transfer for Universities;
- Intellectual Breakfast “Problems of legal protection of inventions”.

There regular inspection of the results of the project participants is performed in DOT-KTU. DOT-KTU in collaboration with the twinning partners has developed many organic electroactive compounds. A number of these materials demonstrate promising photophysical and photoelectrical properties for high efficiency optoelectronic devices. The scientists from Dresden Technical University and DOT-KTU have filled two patent applications. The patent applications were submitted to the German Patent and Trade Mark Office (DPMA is the central authority in the field of industrial property protection in German): **Patent DE102014217817A1** and **Patent application P58672**.

Innovation capacity building measures

Internal organisation measures of DOT-KTU:

- Purchased new research equipment e.g. ultra performance liquid chromatography system, differential scanning photocalorimeter;
- DOT-KTU employed two part-time innovation managers and one IP manager. A series of innovation management training modules has been taught by the innovation managers to KTU/DOT-KTU staff. The following training modules have been prepared and presented to DOT-KTU staff: Creativity, Problem solving, Negotiation, Project Management, and H2020 proposal preparation.
- Purchased new research equipment: Real time ATR FTIR spectroscopy system; Thermal analysis system (TGA and Photo DSC); UPLC MS system; Chemical crystallography system.

External organisation measures of DOT-KTU:

- Organised international scientific conferences Baltic Polymer Symposium 2013, Baltic Polymer Symposium 2014, Baltic Polymer Symposium 2015.

Results Achieved

Deliverable No	Due Date	Actual Date	Deliverable Description
D5.1	M18	M18	IP Strategy Report – Initial Version
D5.2	M36	M39	IP Strategy Report – Final Version
D5.3	M18	M22	Interim report on IP Analysis and Patent Filing
D5.4	M36	M39	Final report on IP Analysis and Patent Filing

Milestone No	Due Date	Actual Date	Deliverable Description
MS2	M18	M18	IP Strategy Report (Completed Initial Version)
MS3	M36	M39	IP Strategy Report (Completed Final Version)

1.3.7 WP6: Ex-Post Evaluation

The aim of this Work Package was to ex-post evaluate the performance of DOT-KTU in terms of its market orientation, international position, scientific/academic position, education and



governance system, in order to ensure its research quality and innovation capability beyond the CEOSeR project.

The evaluation of the research quality and innovation capability, including management and infrastructure – of DOT-KTU and its Centre of Excellence for Organic Semiconductor Research was conducted by four international, independent experts who constituted the CEOSeR Evaluation Board. The experts were nominated by the Commission and chosen from industry and academia with a range of knowledge and experience in top-level organic semiconductor research.

All visits of the experts to DOT-KTU were conducted. The first one or two visits were dedicated to the collection of the information through meetings with DOT-KTU staff, review of relevant documents (existing strategies, plans, staff policy documents, etc.). DOT-KTU provided all the relevant documents and assisted the experts in obtaining the required information. The management team presented a comprehensive picture of DOT-KTU: where DOT-KTU started, how it has evolved and where it is going, including the identification of its competitors. This also included a detailed review of the research and innovation performance indicators – what they are, how they have evolved over the course of the project, and where DOT-KTU aims to be in the future.

The last visit of the CEOSeR Evaluation Board produced a CEOSeR Evaluation Report, which was presented and discussed during a roundtable meeting with the representatives of administration of Kaunas University of Technology, Kaunas Science and Technology Park, Research Council of Lithuania, Lithuanian Academy of Sciences, Association Santaka Valley, Institute of Materials.

Based on the roundtable discussions, DOT-KTU produced a CEOSeR Road Map Report defining specific agreed goals and activities for the research centre over the following 5+ years.

Results Achieved

Deliverable No	Due Date	Actual Date	Deliverable Description
D6.1	M40	M41	CEOSeR Evaluation Report
D6.2	M42	M42	CEOSeR Road Map Report

Milestone No	Due Date	Actual Date	Deliverable Description
MS4	M40	M41	Completed CEOSeR Evaluation Report
MS5	M42	M42	Completed CEOSeR Road Map Report

1.3.8 WP7: Project Management

This Work Package describes how the CEOSeR project was managed by the Project Co-ordinator and individual Work Package Leaders to ensure the timely and efficient implementation of the project and to ensure optimised outcomes from involved partners in their areas of expertise as well as synergy across the research partnerships.

Communication with the European Commission

The Project Co-ordinator has been the main person for any communication with EC during all project period.

Administration of the financial contribution

The planning of resources has been done so as to accommodate a realistic distribution of resources, based on the ongoing project situation.

The finances were carefully managed including:



- reallocation of the budget,
- management of the funds received from EC,
- suspending or terminating part of the contracts or participation of contractors,
- handing actions regarding a defaulting partner.

All payments were made without delay.

Communication, organization of project meetings and reporting

Communication within the Steering Committee has been ensured through the normal means such as electronic mail and in-person Kick-Off and Steering Committee meetings. Recommendations from the Steering Committee were collected and integrated. Technical documentation generated by the project have been exchanged in electronic format. To monitor the status of the project the cost statements and progress reports, annual and final reports have been prepared.

Legal and administrative issues

The Project Co-ordinator together with Management Team:

- managed EC contract including obtaining contract and Partnership Agreement signatures from the participants, handling the funds and maintained the interface with the Project Officer assigned by EC,
- ensured that the project schedule and objectives were maintained,
- ensured that the project maintained relevance to the programme objectives,
- coordinated the preparation, production and distribution of all deliverables and progress reports to EC;
- maintained appropriate communications with the twinning partners.

Management of Knowledge

The project team made optimum use of electronic instruments to support communication, information flow and the management of knowledge.

Management of Intellectual property

Intellectual properties, copyrights and authorship resided within the research organisations originating the material.

Results Achieved

Deliverable No	Due Date	Actual Date	Deliverable Description
D7.1	M2	M2	Project Kick Off Meeting Minutes
D7.2	M2	M2	Project Presentation Slides
D7.3	M3	M3	Project Quality Plan
D7.4	M13	M13	Steering Committee Report – Year 1
D7.5	M25	M25	Steering Committee Report – Year 2
D7.6	M40	M41	Steering Committee Report – Year 3
D7.7	M42	M42	Final Plan for the Use and Dissemination of Foreground
D7.8	M42	M42	Report on Awareness and Wider Societal Implications



1.4 The potential impact (including the socio-economic impact and the wider societal implications of the project so far) and the main dissemination activities and exploitation of results

1.4.1 Impact

No 1 *“Better integration of the selected research team in the European Research Area as a whole (long lasting partnership with research groups elsewhere in Europe)”*

DOT-KTU created this impact via their activities to boost its Research Excellence:

- DOT-KTU activities dedicated to **“Know-How and Experience Exchange”** (see Work Package 1). DOT-KTU exchanged know-how and experience in areas such as A1) Electroactive molecular glasses for OLED and OPV applications, A2) Low-molar-mass materials with increased molecular order and high charge mobilities for OFET applications, B1) Charge-transporting polymers and dendrimers for OPV and OFET applications, and B2) Photo-cross-linkable electroactive systems for OLED applications, by exchanging research staff, by providing and receiving training courses, and by devising bilateral and EU research proposals. The collaborations took place with five specialist research organisations from across Europe: Universitat Politècnica de Catalunya (UPC), Katholieke Universiteit Leuven (KULeuven), University of Cergy-Pontoise (UCP-LPPI), Technische Universität Dresden (TU-Dresden) and Novald GmbH (Novald).
- DOT-KTU activities dedicated to **“Workshop, Conference, Dissemination and Promotion Activities”** (see Work Package 4). DOT-KTU researchers have lengthy experience in organizing various conferences and workshops. This activity was extended and three international conferences i.e., Baltic Polymer Symposium, were held during 2013, 2014 and 2015. CEOSeR used to invite prominent European attendees to give tutorials and courses to the CEOSeR researchers. Furthermore, DOT-KTU researchers attended 24 international conferences and workshops, in order to present their research results and latest developments thanks to the CEOSeR project.
- DOT-KTU activities dedicated to **“Ex-Post Evaluation”** (see Work Package 6) involved a CEOSeR Evaluation Board – comprised of international, independent experts providing practical recommendations on how DOT-KTU can maintain its “R&D excellence” and contribute further in ERA.

No 2 *“Upgraded RTD capacity and capability (human potential: number of new researchers & training of research staff; material potential: modern equipment) as well as the quality of research carried out by the beneficiary research entities”*

DOT-KTU created this impact through specific ‘capacity building’ activities in several Work Packages:

- DOT-KTU activities dedicated to **“Know-How and Experience Exchange”** (see Work Package 1). DOT-KTU exchanged know-how and experience by exchanging research staff, by providing and receiving training courses, and by devising bilateral and EU projects. The collaborations took place with five specialist research organisations from across Europe: UPC, KULeuven, UCP-LPPI, TU-Dresden and Novald.



- ❑ DOT-KTU activities dedicated to “**Recruitment by DOT-KTU**” (see Work Package 2). DOT-KTU hired seven experienced Lithuanian or international researchers with international level expertise in electroactive low-molar-mass materials for OLAE technologies and polymeric and dendritic materials for OLAE technologies. Also, one IP Manager and two part-time Innovation Managers were hired. The managers trained staff in IP issues and innovation management techniques.
- ❑ DOT-KTU activities dedicated to “**Development and Upgrading of Research Equipment**” (see Work Package 3). DOT-KTU developed their existing research facilities by upgrading and purchasing new equipment.

No 3 “*Improved research capacity for increased contribution to regional economic and social development*”

DOT-KTU created regional economic and social impact through the activities described in several work packages:

- ❑ Among DOT-KTU activities dedicated to “**Workshop, Conference, Dissemination and Promotion Activities**” (see Work Package 4) were the organisation of regular workshops (1 or 2 per year) for two-way knowledge transfer about OLAE technology related research activities with regional industry and other research institutions from the electronics, manufacturing and chemicals sectors. Lithuanian industry received information on the latest technological developments giving them a significant competitive advantage.
- ❑ DOT-KTU activities dedicated to “**Recruitment by DOT-KTU**” (see Work Package 2). CEOSeR contributed to reversing the ‘brain-drain’ of Lithuanian scientists that move to research centres in other parts of Europe and the World. DOT-KTU hired seven Experienced Researchers. The new staff had expertise in electroactive low-molar-mass materials for OLAE technologies and polymeric and dendritic materials for OLAE technologies. Also, one IP Manager and two part-time Innovation Managers were hired and who trained staff in IP issues and innovation management techniques.
- ❑ DOT-KTU activities dedicated to “**Development and Upgrading of Research Equipment**” (see Work Package 3). DOT-KTU developed their existing development facilities by upgrading and purchasing new equipment. The availability of the new and upgraded test equipment is used in national/regional research projects.

No 4 “*Improvement of participation of the applicant’s entity in H2020 projects and other important European programmes*”

DOT-KTU created this impact through activities described in work package 1:

- ❑ DOT-KTU’s activities dedicated to “**Know-How and Experience Exchange**” (see Work Package 1) developed their research partnerships with several European research organisations who have excellent track records in EU collaborative research projects. In addition, bilateral seminars were organised between DOT-KTU and the twinning partners, in order to discuss potential joint research proposals. Successful partnerships have been established with H2020 projects PHEBE and EXCILIGHT.



No 5 *“Improvement of the applicant’s innovation potential”*

DOT-KTU created this impact through several specific means:

- DOT-KTU activities dedicated to **“Elaboration of an Intellectual Property and Innovation Capacity Building Plan”** (see Work Package 5). DOT-KTU implemented IP capacity building and innovation capacity building measures. With respect to IP capacity building, DOT-KTU undertook institutional level measures such as developing an IP strategy, hiring an IP Manager and involving staff from DOT-KTU Innovation Office in twinning actions. Furthermore, departmental level measures involved DOT-KTU’s research staff conducting IP analysis relevant to Research Topics A and B. With respect to innovation capacity building, DOT-KTU undertook internal organisation measures such as hiring Innovation Managers, investing in new and upgraded research equipment, and implementing an innovation training system to upgrade competences of the research staff in IP issues and innovation management techniques. Meanwhile, external organisations measures involved promoting R&D capability of DOT-KTU during dissemination workshops with the regional electronics and chemical sector, hiring an IP Manager to help transfer DOT-KTU IP into preparation of national and EU R&D proposals.

1.4.2 Dissemination activities and exploitation of results

CEOSeR has adopted a multiple concurrent dissemination approach geared towards different stakeholders to the project. There has been a full programme of scientific papers and presentations related academic and technical conferences. The project has also disseminated results at industrial events, for instance through publication of papers and articles or presentations at different seminars and conferences.

The presentations of project results at conferences and workshops have been an excellent opportunity not only to disseminate the project results, but also to exchange knowledge with other experts in the field as well as to collect feedbacks from industry and the academia.

A broader interaction with the industry has also enabled the consortium to obtain a fair assessment of the market potential of CEOSeR and its position in the broader business spectrum, which has also been relevant in the context of the CEOSeR exploitation plans and take-up. In order to get appropriate input from the industry, the project has organised several workshops and one-on-one interactions to solicit input and guidance from other industrial and public partners in the CEOSeR value chain, aligned with appropriate industry events and end-user events.

A range of dissemination materials was produced, including:

- public website
- leaflet
- posters
- organized workshops and conferences
- external workshops and conferences
- publications in peer reviewed journals and conference papers
- market research report

Official project website

The official CEOSeR project website is available since March 2013 (month 3 of the project) at www.ceoser.ktu.lt

The objective of this website is to provide information regarding the project addressed to the public. During the project lifetime, website visitors were informed about the project's concept, progress and innovative results.

CEOSeR
Centre of Excellence in Organic Semiconductor Research

Home Project Details Twinning Partners Publications Contact Events and News

Introduction

The aim of the project

The overall aim of the CEOSeR project is to upgrade the research and innovation capacity at the Department of Organic Technology, Kaunas University of Technology (DOT-KTU) to the highest European level in organic semiconductor research. DOT-KTU's existing scientific expertise and facilities will be further developed through a range of capacity building activities derived from DOT-KTU's SWOT analysis. The activities will increase DOT-KTU's strength and visibility in the most advanced topics of organic technology: A) Electroactive low-molar-mass materials for OLAE technologies and B) Polymeric and dendritic materials for OLAE technologies

Central to the activities are twinning partnerships with five specialist research organisations: Universitat Politecnica de Catalunya, Katholieke Universiteit Leuven, University of Cergy-Pontoise, Technische Universitat Dresden and Novaled AG. DOT-KTU will increase its human potential by hiring experienced researchers, an IP Manager and an Innovation Manager and organising know-how exchanges and trainings for existing and new staff with twinning partners. DOT-KTU will increase its technology potential by upgrading and purchasing new equipment including an FTIR ATR spectrometer, differential photocalorimeter, liquid chromatography system, dielectric spectrometer and photoelectron spectrometer. To ensure its research quality and innovation capability, DOT-KTU will be ex-post evaluated by a team of international, independent experts.

[View on the European Commission's CORDIS Website...](#)

Vacancies

Figure 3: <http://www.ceoser.ktu.lt>



Leaflets

The project leaflets were designed early in the project. They provide a thorough but simple to understand description of the project's concept. The leaflets are available in English language. The leaflets were distributed at project events, such as workshops, and at other events where Steering Committee members participated.

About the project	Contact Information	CEOSeR
<p>Overall aim</p> <p>The overall aim of the CEOSeR project is to build the research and innovation capacity at the Department of Organic Technology, Kaunas University of Technology (DOT-KTU), to the highest European level - in novel organic semiconducting materials and OLAE devices - and create a European Centre of Excellence in Organic Semiconductor Research.</p> <p>~</p> <p>The Centre of Excellence will be created by developing DOT-KTU's existing scientific expertise (34 research staff, which consists of 23 full time members and 11 PhD students) and research facilities and collaborating closely with the twinning partners.</p> <p>~</p> <p>CEOSeR will last 42 months and be led by a dedicated team of researchers from DOT-KTU. The Institute has a first class record of R&D in organic semiconductors with DOT-KTU staff having published extensively in international, peer-reviewed journals.</p>	<p>Coordinator: Prof. Juozas Vidas Gražulevičius</p> <p>Address: K Donelaicio 73, Kaunas, Lithuania Kaunas University of Technology</p> <p>Tel: +370-37300193 Fax: +370-37300152</p> <p>juozas.grazulevicius@ktu.lt</p>  <p>www.ktu.lt</p>	<p>Centre of Excellence in Organic Semiconductor Research</p>  <p style="writing-mode: vertical-rl; transform: rotate(180deg);">2013-2016</p>   <p>Co-funded by the European Union</p>

Figure 4: CEOSeR leaflet 2013

Posters

For the workshops and for the organized conferences, special posters were prepared and distributed to stakeholders to advertise the events of the CLOSER project.



CEOSeR Centre of Excellence in Organic Semiconductor Research

CEOSeR

Building the research and innovation capacity at the Department of Organic Technology, Kaunas University of Technology, to the highest European level in novel organic semiconducting materials and OLAE devices and creating a European Centre of Excellence in Organic Semiconductor Research.

Research topics

- Electroactive low-molar-mass materials for OLAE technologies
- Polymeric and dendritic materials for OLAE technologies

Twinning partners:

- 
Universitat Politècnica de Catalunya (UPC)
- 
Katholieke Universiteit Leuven (KULeuven)
- 
Université de Cergy-Pontoise (UCP-LLPI)
- 
Technische Universität Dresden (TU-Dresden)
- 
Novaled AG


Coordinator: Prof. Juozas Vidas Gražulevičius
Address: K Donelaičio 73, Kaunas, Lithuania
Kaunas University of Technology (KTU)

www.ceoser.ktu.lt
2013-2016




Figure 5: CEOSeR poster 2013



CEOSeR workshops

The DOT KTU dissemination workshops with the participation of the local companies of chemical and electronic sectors were organized during the International Conference of Lithuanian Chemical Society “Chemistry and Chemical Technology”.

1st workshop: “Chemistry and Chemical Technology 2014” was held on the 24th of April 2014 at Kaunas University of Technology, Kaunas, Lithuania.

2nd workshop: “Chemistry and Chemical Technology 2015” was held on the 23th of January 2015 and took place at Vilnius University, Vilnius, Lithuania.

3rd workshop: “Chemistry and Chemical Technology 2016” was held on the 29th of April 2016 at the Lithuanian Academy of Science, Vilnius, Lithuania.

Discussed issues during these workshops with the representatives from the local industry :

- possibilities of the cooperation in the future projects;
- cooperation leading to development of the high-tech production: materials, devices etc;
- search for the markets for this production.

The participants from industry:



Four workshops with the leading European companies in organic electronics were organized:

1st workshop was held on 30th of January 2014 at Institut für Angewandte Photophysik (IAPP), Dresden, Germany. The participants agreeded to prepare a project proposal for H2020 programme. The issues concerning prototype production, required materials, characterisation methods were discussed. The requirements for the final prototype devices were clarified.

2nd workshop was held on 3rd and 4th of February 2015 at company Novald GmbH, Dresden, Germany. It was dedicated to discuss the innovative high-efficiency blue emitters for white OLEDs, in order to create a major breakthrough in the performance of OLED lighting.

3rd workshop was held on 9th of July 2015 at Durham University, Durham, UK. The workshop was intended to bring together academic and industrial researchers for the discussion of issues and the exchange of ideas about the prototype production, requirements for materials, characterisation methods.

4th workshop was held on 23rd of February 2016 at IAPP, Dresden, Germany. It was dedicated to discuss the most promising directions of the development of organic electroactive materials for (opto)electronic devices. The attention of the participants was focused on the photophysical

and photoelectrical properties of small molecules and conjugated polymers intended for the application in OLEDs and photovoltaic devices.

The participants from industry:



CEOSeR conferences

Three international conferences were organized:

1st conference: “Baltic Polymer Symposium 2013” was held between the 18th and 21st of September 2013, in Trakai, Lithuania. The website of the Baltic Polymer Symposium 2013 is <http://www.bps2013.eu/>, where all the abstracts of all presentations are publicly available and downloadable.



2nd conference: “Baltic Polymer Symposium 2014” was held between the 24th and 26th of September 2014, in Laulasmaa, Estonia. The website of the Baltic Polymer Symposium 2014 is <http://www.ttu.ee/bps2014#> where all the abstracts of all the presentations are publicly available and downloadable.



3rd conference: “Baltic Polymer Symposium 2015” was held between the 16th and 18th of September 2015, in Sigulda, Latvia. The website of the Baltic Polymer Symposium 2015 is <http://www2.ktf.rtu.lv/PMI/htm/konferences.html> where all the abstracts of all the presentations are publicly available and downloadable.



The organized workshops and conferences influenced the work in the CEOSeR project. The results are recorded in the deliverables of work package 4.

External workshops and conferences

During the implementation period of the project, members of the CEOSeR project participated in workshops and conferences. These events have been an opportunity to establish or reinforce links with other projects, to identify and use synergies between research projects and to figure out the requirements and relevant topics for future research and collaborations. Successful partnerships have been established with H2020 projects PHEBE and EXCILIGHT.

Publications in peer reviewed journals and conference papers

Relevant results were published in 15 journals and 70 conference papers. List of publications and conference papers is presented in Section 1.3.5.

Market research report

In order to ensure the sustainability of the Centre of Excellence, the purpose of this market research report was to help DOT-KTU to identify and exploit R&D opportunities in organic semiconductor research during the next 5 years. Consequently, the report has been structured in the following sections:

- ❑ Organic semiconductor and Related Sectors which provides a synthesis of the organic electronics sectors with respect to the factors driving industrial R&D;
- ❑ DOT-KTU R&D Capabilities which summarizes DOT-KTU’s organic semiconductor research activities and laboratory facilities;
- ❑ Potential Research Funding Sources which highlights funding programmes in Lithuania and in Europe that can support organic semiconductor related R&D;
- ❑ Potential Research Partners which identifies and recommends European organizations that successfully participate in organic semiconductor related R&D projects;
- ❑ Strategic Next Steps which outlines practical steps over the next five years DOT-KTU to exploit the available R&D funding opportunities.



1.5 The address of the project public website, if applicable as well as relevant contact details

The CEOSeR website can be found at the following link: <http://www.ceoser.ktu.lt>

Coordinator contact details

KAUNO TECHNOLOGIJOS UNIVERSITETAS





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List of twinning partners

	Twinning partners	Country	
UPC	Universitat Politecnica de Catalunya	Spain	
KU Leuven	Katholieke Universiteit Leuven	Belgium	
UCP-LPPI	University of Cergy-Pontoise	France	
TU-Dresden	Technische Universität Dresden	Germany	
Novalled	Novalled GmbH	Germany	