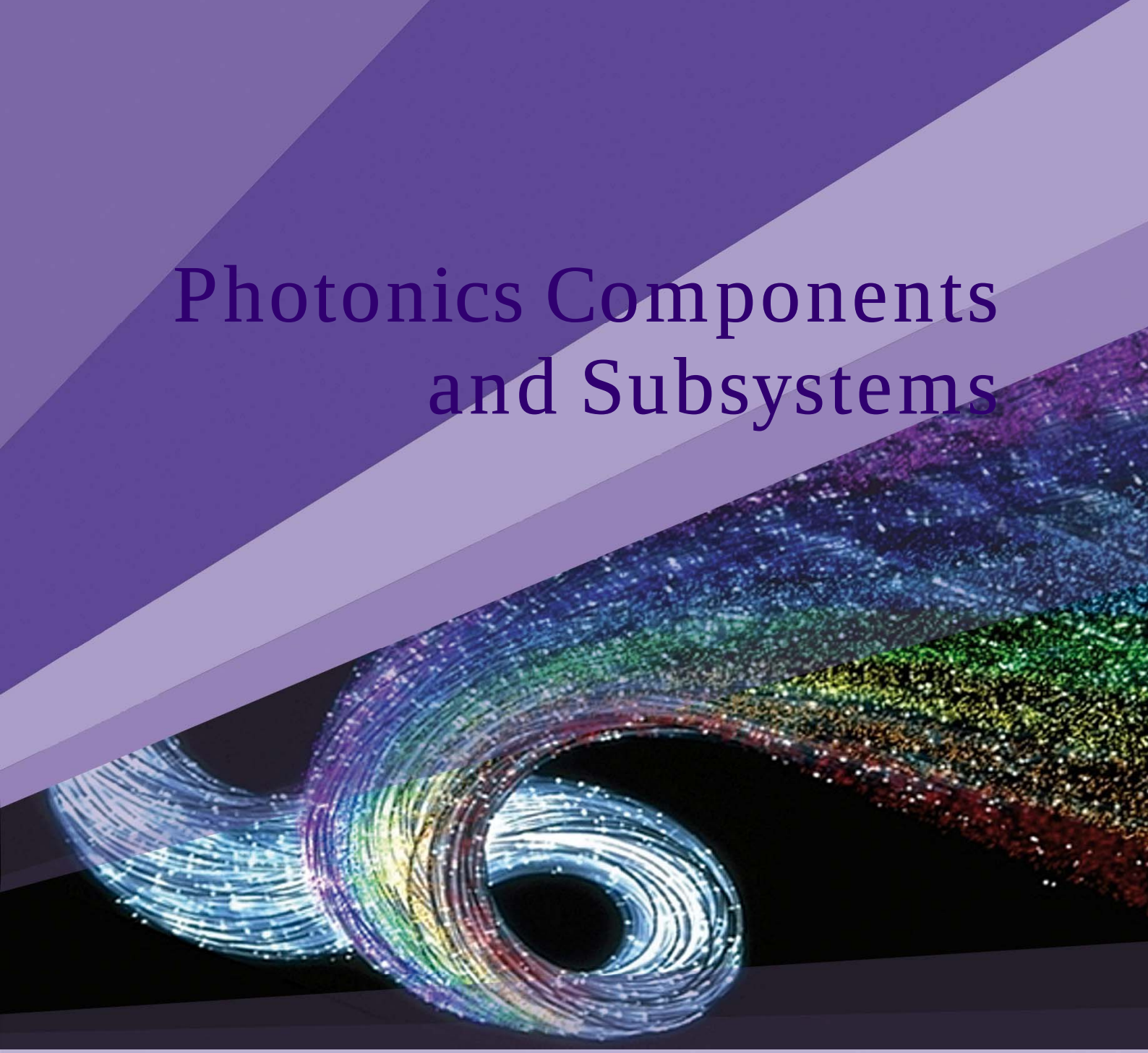
Photonics Components and Subsystems



In the 7th Framework Programme

New Projects from Call 4

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Photonics Unit

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BioEGOFET

Project n°: 248728
Project Title: Electrolyte-Gated Organic Field-Effect BIOsensors

Start date: 01/02/2010
End date: 31/01/2012

Total cost: 2 372 347,00 €
Funding: 1 830 000,00 €

Partners:

- UNIVERSITE PARIS DIDEROT - PARIS 7, FR
- VALTION TEKNILLINEN TUTKIMUSKESKUS, FI
- UNIVERSITA DEGLI STUDI DI BARI, IT
- LINKOEPINGS UNIVERSITET, SE
- Ani Biotech Oy, FI
- ACREO AB, SE
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FR

Abstract:
Electronic transduction can open new perspectives for point-of-care diagnosis and treatment monitoring. In this respect, label free, organic field-effect transistor (OFET) sensors have recently raised the interest of the organic-electronic community. The EGOFET biosensor aims at an electronic transduction of a bio-recognition event, eventually leading to an amplified response. The sensor combines the specificity of a de-fined bio-probe with the label-free and high sensitivity of the field-effect transduction principle. The recognition will be achieved through antigens, antibodies or membrane proteins placed on top of the organic semiconductor, right where the electrical transport occurs in this dielectrics/oxide-free structure. Supramolecular architectures will be used to immobilize the bio-probes into polymeric or phospholipid layers to maximise recognition capabilities and minimize non-specific binding and fouling. High sensitivity will be achieved by exploiting conformational changes and/or charge generation effects occurring upon the recognition process. To attain low-operating voltage and low-power consumption, the OFET will take advantage of the high capacitance offered by the electrolytic or protonic medium used to carry the analyte up to the semi-conductor surface. Implementation of the devices on paper and plastic substrates will be realized by low-cost printing-compatible technologies. The sensors figures of merit will be assessed by exploiting the highly spe-cific biotin/avidin affinity reaction. A proof-of-principle for a point-of-care relevant application, using the immunoassay approach, will be pursued afterwards.

CELLO

Project n°: 248043
Project Title: Cost-Efficient Lighting devices based on Liquid processes and ionic Organometallic complexes

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 6 111 320,00 €
Funding: 3 958 999,00 €

Partners:

- UNIVERSITAT DE VALENCIA, ES
- SIEMENS AG, DE
- UNIVERSITAET BASEL, CH
- CONSIGLIO NAZIONALE DELLE RICERCHE, IT
- ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, CH
- OSRAM GMBH, DE
- VALTION TEKNILLINEN TUTKIMUSKESKUS, FI

Abstract:
CELLO aims at developing a) thin film flexible and large area lighting sources with power efficiencies >25 lm/W and lifetimes >5000 hours based on light-emitting electrochemical cells (LEC) that rely on phosphorescent ionic transition metal complexes as the single active component and b) a scale-able and roll-to-roll compatible wet processes to deposit the molecular active component and the metal contact, generating fully printed devices, which will lead to an improved cost effectiveness. LECs are promising candidates for use in thin-film lighting technologies as (a) they operate at very low voltages, yielding highly power efficient devices, (b) can be processed from benign solvents, (c) have high tolerance for the active layer thickness and (d) operate with air-stable electrodes that allow for simple architectures and passivation approaches. The goals of the project are:
• Development of ionic-transition metal complexes with high solid state photoluminescence quantum yields.
• Development of roll-to-roll compatible wet processes for preparing large area, amorphous thin films of ionic transition metal complexes on flexible substrates using environmentally friendly solvents.
• Development of novel device architectures for minimizing the production effort while ensuring the highest performance levels.
• Preparation of prototypes of large area lighting foils by successive printing of the electroluminescent materials and the metallic contacts. • Feasibility study for these highly novel and economic thin film lighting foils in terms of their robustness and low-cost processability for general lighting and other applications. In view of the highly inter-disciplinary tasks, CELLO has assembled a consortium comprising organic, inorganic and physical chemists, opto-electronic, materials scientists, device physicists and engineers from leading European groups. The participation of Siemens and Osram ensures a rapid transfer of CELLO into future products.

COPERNICUS

Project n°: 249012
Project Title: Compact Otdm/wdm oPtical rEceiveRs based on photoNic crystal Integrated CircUitS

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 4 179 959,00 €
Funding: 2 865 000,00 €

Partners:

- THALES SA, FR
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FR
- DANMARKS TEKNISKE UNIVERSITET, DK
- THE UNIVERSITY OF NOTTINGHAM, UK
- MERGEOPTICS GMBH, DE
- UNIVERSITA DEGLI STUDI DI FERRARA, IT
- THALES SYSTEMES AEROPORTES S.A., FR
- UNIVERSITE DE RENNES I, FR

Abstract:
COPERNICUS aims to develop compact demultiplexing receivers for 100 Gb/s optical time division multiplexed (OTDM) and wavelength division multiplexed (WDM) signals, based on photonic crystal technology. There is a pressing need for these devices for ultra-high bandwidth data links in server farms, optical storage networks and on-board internet/entertainment systems, where demand is driving the data bandwidth and technology integration level rapidly upwards. Next generation telecom systems will also benefit from these devices for OTDM and optical packet switching. Their high-speed and bandwidth, together with their ultra-low power consumption and extreme compactness, also make them a very promising technology for seamless cross-chip and off-chip data links for CMOS electronics. This approach has all the hallmarks of a highly disruptive technology with the potential to place Europe at the forefront of photonics. COPERNICUS targets advances in the physics, technology, modelling, and integration of photonic crystal devices. Key devices include high-speed all-optical gates, low-crosstalk wavelength drop filters, and high-speed integrated photodetectors. These devices rely on very strong light-matter interactions arising from the large, ultrafast nonlinear optical response of III-V semiconductors and the strong resonant field enhancement in photonic crystals. This is ideal for filters and all-optical gates, enabling a dramatic reduction in size and switching energy. Their switching energy*delay product is two orders of magnitude smaller than that of competing technologies. Modelling will consider carrier plasma (spectral and spatial) contributions to the nonlinear optical response and develop a robust optical, thermal and electronic design tool for photonic crystal devices. New levels of photonic crystal integration will be pursued to combine these devices and achieve complex all-optical functions attractive to both medium- and long-term markets.

COSMIC

Project n°: 247681
Project Title: Complementary Organic Semiconductor and Metal Integrated Circuits

Start date: 01/01/2010
End date: 31/12/2013

Total cost: 9 649 241,00 €
Funding: 6 999 000,00 €

Partners:

- FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, DE
- COMMISSARIAT A L' ENERGIE ATOMIQUE, FR
- INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM VZW, BE
- STMICROELECTRONICS SRL, IT
- NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK – TNO, NL
- TECHNISCHE UNIVERSITEIT EINDHOVEN, NL
- TECHNISCHE UNIVERSITAT BERLIN, DE
- FRIENDLY TECHNOLOGIES LTD, UK
- CONSIGLIO NAZIONALE DELLE RICERCHE, IT
- UNIVERSITA DI CATANIA, IT
- FLEXINK, UK

Abstract:
COSMIC will advance the state of the art of complementary organic circuits, i.e. circuits combining n-type and p-type organic thin film transistors (OTFTs). The project comprises extensive research on technology, circuit design, OTFT modeling and characterization. The technology effort includes material and printing processes co-development (incl. LC polymers) and focuses on large area and highly productive in-line compatible processes. COSMIC's research will strongly contribute to advancement of the scientific knowledge in organic electronics. The use of complementary transistors will enable major breakthroughs in performance and application potential of OTFT circuits. Complementary digital circuits show a dramatically improved noise margin, allowing higher complexity and yield compared to p-type-only circuits. They can work at lower supply voltage (often below 10V) resulting in reduced power consumption and better integration potential between silicon and organic electronics. High complexity will enable many new applications for organic digital circuits. In COSMIC we selected two specific logic applications as demonstrators: a display line driver and an ALU. The availability of complementary devices will also enable the design of analogue circuits using OTFTs, a basically unexplored field at the moment. In COSMIC an analogue to digital converter coupled to a temperature sensor will be demonstrated, showing for the first time the potential of OTFTs in the sensors and actuator market. A silent authentication tag comprising a first organic RF receiver will also be build, to show organic electronics' potential in the field of item-level, secure tracking of goods using realistic protocols. All COSMIC applications are of direct relevance to the industrial partners within the consortium and demonstrate the capability of organic complementary technology to generate value for the European industry at large.

e-LIFT

Project n°: 247868
Project Title: Laser printing of organic/inorganic material for the fabrication of electronic devices

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 4 163 312,00 €
Funding: 2 995 000,00 €

Partners:

- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FR
- PAUL SCHERRER INSTITUT, CH
- UNIVERSITY OF SOUTHAMPTON, UK
- NATIONAL TECHNICAL UNIVERSITY OF ATHENS, GR
- MICROSENS S.A, CH
- UNIVERSITAT DE BARCELONA, ES
- EIDGENOESSISCHE MATERIALPRUEFUNGS- UND FORSCHUNGSANSTALT, CH
- INSTITUTUL NATIONAL DE CERCETARE DEZVOLTARE PENTRU FIZICA LASERILOR PLASMEI SI RADIATIEI, RO
- CONSIGLIO NAZIONALE DELLE RICERCHE, IT
- BIOSENSOR S.R.L., IT
- ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT DES METHODES ET PROCESSUS INDUSTRIELS – ARMINES, FR
- LASER MICROMACHINING LIMITED, UK
- ACXYS TECHNOLOGIES, FR
- TOPLINK INNOVATION, FR
- TAGSYS, FR
- ECOLE NATIONALE SUPERIEURE DES MINES DE SAINT-ETIENNE, FR
- FUNDACIO BOSCH I GIMPERA, ES
- UNIVERSITE DE LA MEDITERRANNEE AIX-MARSEILLE II, FR

Abstract:
The main purpose of this project is the development of the Laser-Induced Forward Transfer (LIFT) process that permits the deposition of a wide variety of materials, with high spatial resolution (a few micrometers) for the manufacturing of electronic devices. It has been successfully applied so far in laboratory-scale trials for the deposition of organic and inorganic compounds, polymers and biomaterials on various substrates and the realisation of devices such as OLEDs or TFTs. Breakthrough This process will address the same market as inkjet printing, but it should be significantly faster, doesn't require any post-annealing, allows for the deposition of multilayer structures without any risk of undesirable material mixing and can enable printing of a wide range of materials and phases. The ability of printing such a diverse range of materials with a unique process opens up new perspectives for increasing the performances of devices. Objectives The aim of the present project is to integrate the expertise in laser physics, chemistry and microelectronics from academics, integrators and product manufacturers from industry in order to validate this technology, define its capabilities and its limits, and finally to ensure its successful transfer towards real-world applications in manufacturing. - Our first objective is to optimize the LIFT process for representative materials and substrates (flexible and rigid) in order to solve the potential technological blocking points and to determine the process windows. - The second objective is to validate the LIFT process. Some specific applications will be addressed and that will lead to the realisation and characterisation of components like TFTs, OLEDs, sensors, energy harvesters, and the laser printing of the most promising of these composites onto RFID tags. This scientific effort will pave the way to the definition of the laser printing prototype together with reliability and productivity considerations

FlexNet

Project n°: 247745
Project Title: Network of Excellence for building up Knowledge for improved Systems Integration for Flexible Organic and Large Area Electronics (FOLAE) and its exploitation
Start date: 01/01/2010
End date: 31/12/2012
Total cost: 4 706 043,00 €
Funding: 4 000 000,00 €
Partners:

- VDI/VDE INNOVATION + TECHNIK GMBH, DE
- CSEM CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA - RECHERCHE ET DEVELOPPEMENT, CH
- COMMISSARIAT A L' ENERGIE ATOMIQUE, FR
- ARISTOTELIO PANEPISTIMIO THESSALONIKIS, GR
- VALTION TEKNILLINEN TUTKIMUSKESKUS, FI
- ENTE PER LE NUOVE TECNOLOGIE, L'ENERGIA E L'AMBIENTE, IT
- UNIVERSITAT ROVIRA I VIRGILI, ES
- POLITECHNIKA LODZKA, PL
- TECHNISCHE UNIVERSITAET CHEMNITZ, DE
- UNIVERSITATEA POLITEHNICA DIN BUCURESTI, RO
- UNIVERSITY OF PATRAS, GR
- USTAV MAKROMOLEKULARNI CHEMIE AV CR, v.v.i., CZ
- POLITECHNIKA WARSZAWSKA, PL
- UNIVERSITAT AUTONOMA DE BARCELONA, ES
- UNIVERSIDADE DO ALGARVE, PT
- UNIVERSITA DI CATANIA, IT
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FR
- UNIVERSITE DE BORDEAUX I SCIENCES ET TECHNOLOGIES, FR
- INSTITUT POLYTECHNIQUE DE BORDEAUX, FR

Abstract:
In the NoE FlexNet 17 participants from eleven European countries work together in order to support Europe in becoming a world leader in Flexible, Organic and Large Area Electronics (FOLAE). FlexNet aims at interlinking Europe's FOLAE-expertise in the domains of science, technology development, components, devices and systems integration technologies. A special emphasis will be set on the subsequent commercial exploitation of FOLAE-based systems knowledge especially through SMEs in order to enable a wide spread FOLAE-based future businesses in Europe. The NoE FlexNet will support the integration process of the scientific excellence of FOLAE-oriented European research on Materials, Devices and Systems. This part is complementary to the NoE PolyNet efforts. In addition FlexNet will integrate excellent scientific capacities from Southern and Eastern Europe. FlexNet partners have identified the organic transistor as the most crucial building block in order to realised integrated organic systems. Therefore the scientific focus of the NoE FlexNet will be set on the application of FOLAE-specific Organic Semiconductors as well as Supporting Materials for OTFTs including Interface Properties, Barrier Materials, Characterisation, and OTFT Device Integration into Systems. Further topics of dedicated attention and activity will be on establishing know-how on Devices Characterisation, Systems Integration, Modelling and Design of Systems, and Manufacturing Processes for Systems. Accordingly, NoE FlexNet will be structured in three platforms: - A platform FOLAE Materials and Devices Integration, - A platform Systems Integration and - A platform Knowledge, Dissemination and Transfer to industry The knowledge associated to these topics will actively be made available to European stakeholders from research and industry, especially SMEs, in Southern and Eastern Europe. This will make FlexNet a bidirectional catalyst for information transfer in the FOLAE area between West-Central- and South-Eastern Europe. FlexNet will work in close contact with existing coordination actions in the FOLAE area like the Quadriga projects. This will ensure additional support in unifying and streamlining the fragmented FOLAE R&D arena in Europe.

HIFLEX

Project n°: 248678
Project Title: Highly Flexible Printed ITO-free OPV Modules

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 4 993 874,00 €
Funding: 3 649 672,00 €

Partners:

- STICHTING ENERGIEONDERZOEK CENTRUM NEDERLAND, NL
- NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK – TNO, NL
- DANMARKS TEKNISKE UNIVERSITET, DK
- FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, DE
- THE UK MATERIALS TECHNOLOGY RESEARCH INSTITUTE LIMITED, UK
- AGFA-GEVAERT A.G., BE
- DR. SCHENK GMBH INDUSTRIEMESSTECHNIK, DE

Abstract:
HIFLEX aims to develop a cost-effective Highly Flexible Printed ITO-free OPV module technology that matches the particular requirements of mobile and remote ICT applications in terms of efficiency under different light conditions, lifetime, cost structure, power to weight ratio and mechanical flexibility. The project intends to accelerate the exploitation of this OPV technology for a wide variety of ICT products in the mobile electronics market. An application-driven research approach will be followed by developing large area, solution processable ITO free OPV using scalable, reproducible and commercially viable printing and coating techniques enabling the low cost production of highly flexible and lightweight OPV products. At the same time it guarantees the technological compatibility with other printed electronic components and systems. The high flexibility and lower costs will be addressed by the solar cell module design we intend to bring into production. The partnership consists of: one SME (Dr Schenk) with invaluable expertise in the inline process and quality control of R2R processed PV, one industry (Agfa) with market tested experience on photographic development of Ag grid lines, PEDOT antistatic coatings and large scale coating as well as developing innovative coating solutions, and five research institutes (ECN, ISE, Risø DTU, Holst centre, MatRI) with a technology focus and with complementary expertise in the field of device and module engineering, up-scaling and large area printing and long-term lifetime testing. We anticipate that this project will result in the demonstration of a new scalable, low cost, solution processable photovoltaic technology and will therefore form the basis of a potentially substantial business opportunity for Europe aiming at developing a new solar cell product with cost and payback characteristics strongly advantaged over existing technologies.

LIMA

Project n°: 248909
Project Title: Improve Photovoltaic efficiency by applying novel effects at the limits of light to matter interaction

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 3 186 950,00 €
Funding: 2 375 000,00 €

Partners:

- UNIVERSIDAD POLITECNICA DE VALENCIA, ES
- INTERNATIONAL SOLAR ENERGY RESEARCHCENTER KONSTANZ, DE
- UNIVERSITA DEGLI STUDI DI TRENTO, IT
- UNIVERSITY OF NEW SOUTH WALES, AU
- FONDAZIONE BRUNO KESSLER, IT
- AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS, ES
- ISOFOTON S.A., ES

Abstract:
The LIMA project exploits cutting edge photonic technologies to enhance silicon solar cell efficiencies with new concepts in nanostructured materials. It proposes nano-structured surface layers designed to increase light absorption in the solar cell while decreasing surface and interface recombination loss. Integration in a back contact design further reduces these interface losses and avoids shading. The project improves light-matter interaction by the use a surface plasmonic nanoparticle layer. This reduces reflection and efficiently couples incident radiation into the solar cell where it is trapped by internal reflection. Surface and interface recombination are minimised by using silicon quantum dot superlattices in a passivating matrix. The distance between quantum dots ensures wave-function overlap and good conductivity. An effective field at the superlattice - crystalline silicon interface ensures that the cell is insensitive to the recombination velocity at this heterojunction, and further increases the collection probability in the quantum dot layer. The dots allow a fundamental efficiency enhancement due to experimentally confirmed multiple exciton generation. This mechanism increases photocurrent and can in theory raise the theoretical single junction efficiency limit from 33% to 44%. These surface plasmonic and quantum dot layers are integrated in a high efficiency crystalline silicon back contact cell. This is designed such that the space charge region is separated from the superlattice – crystalline silicon heterojunction minimising non radiative space-charge recombination. The back contacts and dielectric electrical insulator are designed to maximise back surface reflection and enhance the light trapping of incident radiation without shading losses. The project combines expertise between academic and industrial partners. The goal is a high efficiency cell using novel concepts to enhance proven cell designs.

LOTUS

Project n°: 248816
Project Title: Low-cost highly conductive high resolution structures for flexible large area electronics by high throughput low temperature processing

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 5 518 925,00 €
Funding: 3 700 000,00 €

Partners:

- NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK – TNO, NL
- XENNIA TECHNOLOGY LIMITED, UK
- STICHTING ENERGIEONDERZOEK CENTRUM NEDERLAND, NL
- THE HEBREW UNIVERSITY OF JERUSALEM, IL
- IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE, UK
- FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, DE
- FRIEDRICH-SCHILLER-UNIVERSITAET JENA, DE
- KSW Microtec AG, DE
- AGFA-GEVAERT A.G., BE
- PHILIPS TECHNOLOGIE GMBH, DE

Abstract:
The LOTUS proposal addresses the urgent need for a technology to produce the highly conductive patterns required for high throughput large volume manufacturing of flexible large area electronics. While all printed electronics need “electric wiring” LOTUS specifically targets the applications the most advanced towards commercialization: flexible thin-film photovoltaics, RFIDs, and OLEDs for lighting. The general objective is to provide a simple, low cost, energy efficient, environmentally friendly and R2R compatible platform to produce highly conductive structures with high resolution. The interplay between materials researchers, technology developers and end users allows to generate solutions quickly and effectively with minimum investment and time and to achieve maximum output with minimum risk. This will also accelerate the transfer to mass production. The strategy is based on an integrated approach to address both the common needs and the specific requirements of the most representative applications. The platform developed will reinforce the leading position of the European Industry in flexible OLEDs, PVs, and RFIDs. Moreover, it will be beneficial to any flexible electronics including thin-film transistors, power converters, flexible batteries, printed sensors for biomedical use (point-of-care) and food protection/freshness applications. These devices presently at various stages of development also need an “electric wiring”. Thus LOTUS will contribute to wealth creation and making new technology available to address societal needs. The technologies and materials generated will enable the European Community to be competitive with Asian and North American products (there are presently no conductive inks and sintering tools manufacturers in Europe). LOTUS project will create synergies and cooperation between research groups, equipment manufacturers and end users bringing them to the position of global frontrunners in their respective technology areas.

MOMA

Project n°: 248092
Project Title: Embedded Organic Memory Arrays

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 4 728 866,00 €
Funding: 3 081 000,00 €

Partners:

- NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK – TNO, NL
- INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM VZW, BE
- STMICROELECTRONICS SRL, IT
- RIJKSUNIVERSITEIT GRONINGEN, NL
- UNIVERSITE CATHOLIQUE DE LOUVAIN, BE
- SOLVAY SOLEXIS S.P.A.

Abstract:
The advent of non-volatile flash memory — silicon-based semiconductor memory that does not lose its data when the power is turned off — revolutionized consumer electronics. Similar types of organic memory will play a pivotal role in the wide range of new market opportunities of flexible electronics based on organic transistor technology. Currently, these memory elements do not exist, thus forming a major impediment to the commercialization of flexible and organic transistors. The aim of the MOMA project is to research the materials, process technologies and electronic design to make nonvolatile memory arrays that can be programmed and read electronically using organic thin-film circuitry on very thin, flexible plastic foils such as polyethylene naphthalate. The main strategy is to use soluble ferroelectric polymers in combination with organic semiconductors. Two different device types are considered, thin-film transistors and diodes. The resistive switching that they provide results in a high or a low current response that can read non-destructively. A concrete focus on highly integrated memory demonstrators will be used to drive the research and technology forward, and allows a small, concise list of goals for MOMA: - Develop a high yield process to make re-programmable, non-volatile elements that can be written and read-out electronically using thin-film transistor circuitry on plastic substrates. - Deliver technical prototypes of multi-bit arrays of polymer ferroelectric diodes and/or TFTs with 100 ppi resolution. - Design and fabricate low-temperature, high-quality organic TFT driving circuitry on flexible plastic substrates that can program and read electronically an array of 96 bits.

nanophotonics4energy

Project n°: 248855
Project Title: Nanophotonics for Energy Efficiency

Start date: 01/01/2010
End date: 31/12/2013

Total cost: 3 345 607,00 €
Funding: 2 900 000,00 €

Partners:

- INSTITUT DE CIENCIES FOTONIQUES, FUNDACIO PRIVADA, ES
- LABORATORIO EUROPEO DI SPETTROSCOPIE NON LINEARI, IT
- KUNGLIGA TEKNISKA HOEGSKOLAN, SE
- BILKENT UNIVERSITY, TR
- TECHNISCHE UNIVERSITAET DRESDEN, DE
- COMMISSARIAT A L' ENERGIE ATOMIQUE, FR
- UNIVERSITAT POLITECNICA DE CATALUNYA, ES
- AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS, ES
- UNIVERSITY OF SOUTHAMPTON, UK

Abstract:
The Nanophotonics for Energy Efficiency proposal aims to create a virtual centre of excellence to re-orient and focus nanophotonics research towards the challenges in energy efficient applications. The network will cluster nanophotonic laboratories and research groups in Europe combining their expertise in the development of disruptive approaches to lighting and solar cell technology. The consortium consolidates know-how and resources of 9 different institutions in 6 European countries with complimentary research and development expertise, integrating more than 130 scientists, engineers, technicians and managers in nanophotonics. The project pursues a scientific bottom-up approach to ensure that novel ideas and scientific breakthroughs as well as established proof-of-concepts in academia are promoted along the value chain towards reaching their eventual goal of commercialization. Market and industrial relevance is ensured through the involvement of industry leaders in the Advisory Board. This approach complements the existing top-down, industry-driven projects like e.g. OLED100.eu. The project intends to achieve the overall long-term integration goal by coordinating three main efforts: 1. Realising a strategy for successful integration: creation of new research clusters and a virtual laboratory network that will lead to the creation of a lasting entity that will exist beyond the duration of this NoE 2. Establishing joint research: foster collaborations among the leading groups in nanophotonics for energy efficiency, interchanging knowledge and best practices, and paving the way towards the establishment of common research agendas 3. Spreading knowledge: education and training specially geared towards young researchers and technicians – both on S&T issues as well as on complementary skills like communication, business, entrepreneurial or IPR skills – and dissemination towards the scientific community, industry, and the public in general

P3SENS

Project n°: 248304
Project Title: Polymer Photonic multiparametric biochemical SENSor for Point of care diagnostics

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 3 629 485,00 €
Funding: 2 596 909,00 €

Partners:

- MULTITEL ASBL, BE
- VALTION TEKNILLINEN TUTKIMUSKESKUS, FI
- UNIVERSITY OF GLASGOW, UK
- UNIVERSITE DE GENEVE, CH
- MUSZAKI FIZIKAI ES ANYAGTUDOMANYI KUTATOINTEZET - MAGYAR TUDOMANYOS AKADEMIA, HU
- BAYER TECHNOLOGY SERVICES GMBH, DE
- STRATOPHASE LTD, UK

Abstract:
The detection of chemical or biological substances increasingly appears as an essential concern in order to prevent human or animal health and security related problems. Present analytical techniques are expensive and often require highly specialized staff and infrastructures. The principal need is to perform screening tests, which can be carried out in non-specialized infrastructures, e.g. Point of Care, schools and field, before unambiguous identification in a specialized laboratory. There is thus a need to develop a new detection system that has low-cost and is portable but at the same time offers high sensitivity, selectivity and multi-analyte detection from a sample containing various components (e.g. blood, serum, saliva, etc.). The objective of P3SENS is to design, fabricate and validate a multichannel (50 or more) polymer photonic crystal based label-free disposable biosensor allowing for a "positive/negative" detection scheme of ultra small concentrations of analytes in solution (< 1 ng/mL). The biosensor will be encapsulated in a specifically designed microfluidic system in order to deliver the sample to the multiple sensing zones. The design of the biochip will allow it to be easily inserted in a compact measurement platform, usable by non-specialized practitioners outside of specialized laboratories for carrying simultaneous multi-analyte detection, delivering real-time monitoring, and with an assay duration that will not exceed a few tens of minutes. The photonic chip proposed in this project will be based on polymer Photonic Crystal (PhC) micro-cavities coupled into a planar waveguide optical distribution circuit. The photonic chip will be fabricated with available fabrication technologies - and with an emphasis on low cost substrates (polymer) and fabrication processes (nano-imprint lithography). More generally, P3SENS will push forward the development of low cost disposable biochips based on photonics.

PHOTO-FET

Project n°: 248052
Project Title: Integrated Photonic Field-Effect Technology for bio-sensing functional components

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 4 052 694,00 €
Funding: 2 750 000,00 €

Partners:

- CONSIGLIO NAZIONALE DELLE RICERCHE, IT
- CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA, CH
- MOLECULAR VISION LIMITED, UK
- SAES GETTERS S.P.A., IT
- IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE, UK
- POLITECNICO DI MILANO, IT

Abstract:
The objective of this project is to develop a miniaturized cheap and disposable photonic device for bio sensing that is capable of performing quantitative diagnostic tests that are currently limited to a hospital laboratory setting. Our target product is a disposable device for monitoring cardiovascular health - an EU-wide healthcare priority. To date Microfluidic (or Lab-on-a-Chip) devices have not been well suited to point-of-care applications. Although the chips themselves are cheap and small, they must generally be used in conjunction with bulky optical light-sources and detectors. The lack of an integrated, versatile detection scheme is a major obstacle to the deployment of portable diagnostic devices. Consortium partners have demonstrated that integration of organic diodes and photodetectors is a viable route to meet this need. The purpose of this proposal is to develop a radically new generation of devices, in which organic photonic field-effect transistors are used for both light generation and detection. The use of transistors in place of diodes has four principle benefits. Firstly they can be pre-fabricated on the substrate (the microfluidic chip), ensuring optimal registration between the organic photonic components and the underlying fluidic architecture. Secondly the devices can be completed by depositing a single layer of organic semiconductor followed by the gate electrode, thus avoiding the need for complex multilayered structures. Thirdly in-plane light generation by the transistors provides improved optical coupling into wave-guiding structures, leading to significant performance gains. And fourthly current-multiplying auxiliary transistors can also be included thereby enabling immediate amplification of the signal at the point-of-generation. In combination these factors offer a compelling solution to the challenge of point-of-care detection that will offer unprecedented sensitivity and superior reliability at a markedly reduced cost

PIANO+

Project n°: 247933
Project Title: ERA-NET-PLUS on photonics-based internet access networks of the future

Start date: 01/01/2010
End date: 31/12/2014

Total cost: 22 506 834,00 €
Funding: 7 321 710,00 €

Partners:

- VDI TECHNOLOGIEZENTRUM GMBH, DE
- BUNDESMINISTERIUM FUER BILDUNG UND FORSCHUNG, DE
- THE TECHNOLOGY STRATEGY BOARD, UK
- MATIMOP, ISRAELI INDUSTRY CENTER FOR RESEARCH & DEVELOPMENT, IL
- NARODOWE CENTRUM BADAN I ROZWOJU, PL
- OESTERREICHISCHE FORSCHUNGSFOERDERUNGSGESELLSCHAFT MBH, AT

Abstract:
High speed internet access is recognised as becoming increasingly important as demands for bandwidth increase. One of the key issues for Europe is how to enable ubiquitous broadband access of at least 1 Gb/s per subscriber economically within the next decade, whilst meeting the shorter term needs of system operators and users. Investment in the development of next generation optical access technologies will enable a future network to be deployed which will radically reduce infrastructure costs through removal of local exchanges and much of the metro network. PIANO+ aims at consolidating the respective funding activities throughout Europe and achieving the best possible exploitation of the resources and the innovative potential of European industry and science. This shall be achieved through a joint call focussing on photonic technology and system architectures for the scalable, future proof, cost-effective and energy efficient access network. Topic and basic concept of this EN+ originate from the Mirror Group of the European Technology Platform Photonics21 which is made up of governmental representatives from the Member and Associated States involved with the promotion of photonics.

PLAISIR

Project n°: 247991
Project Title: PLAsmonic Innovative Sensing in the IR

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 3 671 858,00 €
Funding: 2 850 000,00 €

Partners:

- CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA, CH
- VIGO SYSTEMS SA, PL
- XENICS NV, BE
- PHOTON DESIGN, UK
- UNIVERSITY OF ZARAGOZA, ES
- TECHNICAL UNIVERSITY DRESDEN, DE
- QUEEN'S UNIVERSITY BELFAST, UK

Abstract:
The aim of this project is to transfer the latest advances in plasmonics achieved in the visible to the mid-IR. The main objectives of the project are (1) to look at the fundamental limits and develop new simulation tools for plasmons in the mid-IR, (2) to develop plasmon enhanced surfaces for spectroscopic chemical sensing (SCS), and (3) to use plasmon enhanced surfaces for light harvesting technology. The result of the project will include new software, SCS surfaces for infra-red spectroscopy and smart, cheaper, mid-IR photodetectors. The term plasmonics refers to the investigation, development and application of enhanced electromagnetic properties of metallic (nano-) structures and is starting to find applications in a range of photonic devices such as VCSELs and high speed photodetectors. While the promise of plasmonics photonic components in the visible and NIR is very promising, this project will exploit the huge potential for plasmonics in the IR (i.e. the 1.6-16 μm range) that could be truly disruptive. In the mid-IR (a) plasmon losses are much lower than in the visible so the range of possible devices is much larger (b) this area is largely unexplored for applied plasmonics, and (c) IR technology is undergoing a quiet revolution due to key advances such as such room temperature Quantum Cascade Lasers and miniature Fourier transform spectrometers (FTS). This project will help launch the IR revolution by enabling both SCS surfaces and better mid-IR detectors. PLAISIR will develop SCS with sensitivity more than 200 times larger than that of a simple surface. This will be combined with microfluidics and integrated into a FTS. The project will work with both InGaAs and HgCdTe photodetectors, by using LHT to improve their noise performance, and tailor their spectral and polarization response. This project includes 4 major actors in fundamental and applied plasmon research, 3 SMEs and an external advisory board made up of strategic end users and key academics

PLATON

Project n°: 249135
Project Title: Merging Plasmonic and Silicon Photonics Technology towards Tb/s routing in optical interconnects

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 3 403 174,00 €
Funding: 2 599 816,00 €

Partners:

- CENTRE FOR RESEARCH AND TECHNOLOGY HELLAS, GR
- FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, DE
- SYDDANSK UNIVERSITET, DK
- GESELLSCHAFT FUR ANGEWANDTE MIKRO UND OPTOELEKTRONIK MIT BESCHRANKTERHAFTUNG AMO GMBH, DE
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS, GR
- UNIVERSITE DE BOURGOGNE, FR
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FR

Abstract:
PLATON aims to realize a fully integrated Tb/s optical routing system for data networks expecting to deliver important advantages to the end-users as it will enable high-speed communications and ultra-fast access to data information being stored at large computer centers whilst investing in a new technological platform of lower cost, lower power consumption and reduced size requirements. This will allow for the effective consolidation of today's Internet and computer server rooms storing huge amounts of information into smaller-size rack- or even box-interconnect environments. PLATON's routing fabric will employ novel plasmonic switching elements on a silicon motherboard and will develop novel fabrication processes for enabling the merger of plasmonics with silicon nanophotonics and electronics, targeting the combined utilization of small-footprint, high-bandwidth plasmonics structures with the low-loss functional potential offered by the more mature SOI technology. PLATON will evolve upon a whole new generation of miniaturized photonic components including: (a) a new series of fast 2x2 thermooptic plasmonic switches, (b) a small-footprint 4x4 thermooptic plasmonics switch, (c) an optically addressable 1x2 plasmonic switch operating at bitrates in excess of 10Gb/s, and (d) a 2x2 and a 4x4 Tb/s optical routing platforms. To this end, PLATON will pioneer the field of routing for optical interconnects and will provide a completely new technological toolkit, bringing Europe in a leading position world-wide with respect to research efforts in plasmonics for interconnects. Finally, it will open totally new application vistas and opportunities for European industry being active in the field of nanophotonics, given that the active participation of industry within PLATON ensures the industrial take up of the combined plasmonics/photonics functional devices from research elements to commercially available products.

POLARIC

Project n°: 247978
Project Title: Printable, organic and large-area realisation of integrated circuits

Start date: 01/01/2010
End date: 31/12/2013

Total cost: 13 810 590,00 €
Funding: 9 859 375,00 €

Partners:

- VALTION TEKNILLINEN TUTKIMUSKESKUS, FI
- IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE, UK
- JOANNEUM RESEARCH FORSCHUNGSGESELLSCHAFT MBH, AT
- THE SWATCH GROUP RECHERCHE ET DEVELOPPEMENT S.A., CH
- CARDIFF UNIVERSITY, UK
- 3D-MICROMAC AG, DE
- CSEM CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA - RECHERCHE ET DEVELOPPEMENT, DE
- FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V, DE
- INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM VZW, BE
- OBDUCAT TECHNOLOGIES AB, SE
- MICRO RESIST TECHNOLOGY GMBH, DE
- BASF SE, DE
- GESELLSCHAFT FUR ANGEWANDTE MIKRO UND OPTOELEKTRONIK MIT BESCHRANKTERHAFTUNG AMO GMBH, DE
- CIBA SPEZIALITAETENCHEMIE AG, CH

Abstract:
The POLARIC project is to produce a large-area, roll-to-roll manufacturable, high-performance organic integrated circuit technology. High performance means high speed (MHz), low operating voltage (below +/- 5 V), low power consumption, low parasitic capacitance, and high yield (> 99%). We will achieve these goals by extensive development work in devices, circuits and fabrication. On the device level, we will develop organic transistors with channel lengths below 1 micrometre and extremely thin insulator layers below 100 nm. In combination with this we will develop a low power, high yield solution-processed, multilayer organic complementary transistor technology. We will utilize comprehensive circuit modelling to make maximum usage of the resultant increases in device performance. We will upscale the state-of-the-art materials and develop their formulations for large scale production. We will develop a range of different manufacturing tools and techniques for production over large areas on flexible substrates, which will then be combined in-line and upscaled from a sheet process to roll-to-roll. This will give us both the key basic building blocks and the key manufacturing platforms needed to fully implement and realize this technology. We will utilise this to fabricate the two project demonstrators, an active matrix liquid crystal display (32 mm x 35 mm) using thin-film transistors and a radio-frequency identification tag (max. footprint of 50 mm x 50 mm) using complementary logic circuits. Both demonstrators will be high performance and are manufactured on large-area, flexible substrates. The strongest immediate impact of the POLARIC project will be in the packaging and display sectors. However, the development of such fundamental electronic building blocks and fabrication platforms will extend the projects impact to other areas of organic electronics such as sensors, memories, batteries, solar cells, lighting and any combinations of these devices.

PRIAM

Project n°: 248752
Project Title: Printable functionalities for truly autonomous, intelligent lighting and signalling systems

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 3 840 459,00 €
Funding: 2 664 887,00 €

Partners:

- CENTRO RICERCHE FIAT SPA, IT
- VALTION TEKNILLINEN TUTKIMUSKESKUS, FI
- COMMISSARIAT A L' ENERGIE ATOMIQUE, FR
- MICROTEC GESELLSCHAFT FUER MIKROTECHNOLOGIE MBH, DE
- CENTRO RICERCHE PLAST-OPTICA SPA, IT
- SOLARI DI UDINE S.P.A., IT

Abstract:
PRIAM addresses the development of two new product families: •Light emitting autonomous road signs •Autonomous car signals and taillights The underling technology consists on the integration on a plastic foil of: •A solar cell •A thin film battery •Solid state light sources •A sensor of ambient light •A Radio Frequency RF communication element •An energy management processing unit. The developed systems do not need to be connected to an external source of energy, there is no need of expensive cabling or dedicated infrastructures. The new road signs can be easily applied on existing road panels which will then be luminous assuring high visibility in all climate conditions. The average age of car drivers is continuously increasing with associated lower reaction times and lower visual acuity. Benefits are then straightforward in terms of road safety in that a relevant share of car accidents happens at night because of drivers' hesitations due to low visibility of road signs. While the car is approaching the road sign, the RF element communicates with the central processor of the car which can inform the driver by either presenting the information on the display or by a voice synthesizer. The new car signals and taillights are very thin and light; they can be easily integrated into the car body and do not need to be connected to the main battery system. The RF element assures the communication with the central computer and the pedal. The system represents a considerable advantage for conventional cars in terms of the overall lower systems complexity and reduction of fuel consume. However the major advantage is foreseen for the development of efficient electrical vehicle requiring low consume auxiliaries for higher range autonomy. The issue of low cost fabrication is addressed by implementing high throughput heterogeneous processes based on the integration of both printing and laminating technologies into roll-to-roll lines. Additionally, the car lighting systems become cheaper thanks to the low cost production, high throughput and processes implementation. The involvement of two renowned research institutions, two large industries and three SMEs, covering all aspects of the supply chain from research to the final installations, guarantees that the project results will be turned into innovative products having a direct large application potential and exploitable into several other products of the emerging flexible and organic electronics sector with a relevant impact on jobs and economy.

PRIMA

Project n°: 248154
Project Title: Plasmon Resonance for IMproving the Absorption of solar cells

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 3 396 658,00 €
Funding: 2 300 000,00 €

Partners:

- INTERUNIVERSITAIR MICRO-ELECTRONICA CENTRUM VZW, BE
- IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE, UK
- CHALMERS TEKNISKA HOEGSKOLA AB, SE
- PHOTOVOLTECH NV, BE
- QUANTASOL LIMITED, UK
- THE AUSTRALIAN NATIONAL UNIVERSITY, AU

Abstract:
The demand for affordable renewable energy is increasing steadily. Electricity generation by photovoltaic cells is one of the main players in this field, but is hampered by its still relatively high cost compared with other sources of energy. Within this project we investigate promising nanotechnology - based strategies to enhance the performance and/or reduce the cost of different solar cell technologies. Specifically we examine the use of metal nanostructures to enhance the optical absorption of light into different types of solar cells, including crystalline Si, high performance III-V, organic and dye-sensitized solar cells. The enhanced absorption can ultimately lead to thinner and therefore less expensive solar cells due to the use of less material. One of the remaining issues in this field, that of better physical insight in the possible plasmonic enhancement mechanisms, will be studied in detail using calculations and experiments on structures with different degrees of complexity. In parallel, we investigate the manufacturability of these nanostructures and the ease of integrating them into existing process flows for solar cells. This will allow us to examine industrially relevant structures, integrate them into solar cells and test their performance. The performance will be bench-marked and assessed by solar cell companies that are participating in the project. European science traditionally is a leader in both the fields of photovoltaics and nanoplasmonics and this project helps to maintain Europe's strong position. Moreover it provides the participating industrial partners with a competitive advantage, which should create employment and sustainable economic growth in Europe, while simultaneously contributing to a reduction of the emission of greenhouse gases.

QuRep

Project n°: 247743
Project Title: Quantum Repeaters for Long Distance Fibre-Based Quantum Communication

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 2 481 878,00 €
Funding: 1 900 000,00 €

Partners:

- UNIVERSITE DE GENEVE, CH
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FR
- UNIVERSITAET PADERBORN, DE
- LUNDS UNIVERSITET, SE
- ID QUANTIQUE SA, CH
- UNIVERSITE PIERRE ET MARIE CURIE - PARIS 6, FR

Abstract:
The goal of QuRep is to develop a Quantum Repeater - the elementary building block required to overcome current distance limitations for long-distance quantum communication. Quantum Repeaters are the analogue of classical optical amplifiers that permit the cascading of successive fibre optic communication links. Quantum Repeater technology is centred around quantum light-matter interactions at the quantum level in ensembles of rare earth ions frozen in a crystal that store quantum information by coherent control of the quantum degrees of freedom. A clear and well-defined architecture and protocol for a complete Quantum Repeater can be realised with entangled photon pair sources that couple the Quantum memories to fibre optic communication systems. The proof of principle has been shown for all aspects of this approach and QuRep now aims to bridge the gap between fundamental research and industrial projects. The main technological result of the QuRep project will be a quantum repeater. The outcome of the QuREP project will serve as the basis for an industrial initiative, developing the first quantum repeater products. Considering the state of the art, potential difficulties and the chosen development approach, it is reasonable to assume that this technology could be translated into products in the next 10 years with spin-off technologies emerging in the interim period. We bring together the leading European groups in quantum communication, quantum memories, photonic sources and rare-earth-ion spectroscopy and materials as well as a leading quantum communication technology SME to move what has been fundamental research towards commercial feasibility. There are already niche markets for quantum repeaters, should they exist, and the market is expected to grow significantly in the next 10 years.

SOFI

Project n°: 248609
Project Title: Silicon-Organic hybrid Fabrication platform for Integrated circuits

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 3,515,110 €
Funding: 2,499,926 €

Partners

- KARLSRUHER INSTITUT FUER TECHNOLOGIE, DE
- IMEC, BE
- RAINBOW PHOTONICS AG, CH
- SELEX SISTEMI INTEGRATI SPA, IT
- GIGOPTIX-HELIX AG, CH
- RESEARCH AND EDUCATION LABORATORY IN INFORMATION TECHNOLOGIES, GR
- THE UNIVERSITY OF SYDNEY (AU)

Abstract
In the SOFI project, new active optical waveguides and integrated optoelectronic circuits based on a novel silicon-organic hybrid technology are introduced. The technology is based on the low-cost CMOS process technology for fabrication of the optical waveguides - allowing for the convergence of electronics with optics. It is complemented by an organic layer that brings in new functionalities so far not available in silicon. Recent experiments have shown that such a technology can boost the signal processing in silicon far beyond 100 Gbit/s - which corresponds to a tripling of the state-of-the art bitrate. SOFI focuses on a proof-of concept implementation of ultra-fast ultra-low energy optical phase modulator waveguides such as needed in optical communications. These devices will ultimately be used to demonstrate an integrated circuit enabling the aggregation of low-bitrate electrical signals into a 100 Gbit/s OFDM data-stream having an energy consumption of only 5 fJ/bit. However, the SOFI technology is even more fundamental. By varying the characteristics of the organic layer one may also envision new sensing applications for environment and medicine. The suggested approach is practical and disruptive. It combines the silicon CMOS technology and its standardized processes with the manifold possibilities offered by novel organic materials. This way, for instance, the processing speed limitations inherent in silicon are overcome, and an order-of-magnitude improvement can be achieved. More importantly, the new technology provides the lowest power consumption so far demonstrated for devices in its class. This is supported by calculations and first initial tests. The low power consumption is attributed to the tiny dimensions of the devices and to the fact, that optical switching is performed in the highly nonlinear cladding organic material rather than in silicon.

SPEDOC

Project n°: 248835
Project Title: Surface Plasmon early Detection and Treatment Follow -up of Circulating Heat Shock Proteins and Tumor Cells

Start date: 01/01/2010
End date: 31/12/2012

Total cost: 2 496 000,00 €
Funding: 1 900 000,00 €

Partners:

- INSTITUT DE CIENCIES FOTONIQUES, FUNDACIO PRIVADA, ES
- ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, CH
- UNIVERSITE DE BOURGOGNE, FR
- INSTITUT NATIONAL DE LA SANTE ET DE LA RECHERCHE MEDICALE, FR
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, FR

Abstract:
Cancer causes an increased expression of Heat Shock Protein HSP70 in the peripheral blood, at the surface of, and in cancer cells as a result of different sources of stress, including anti-cancer treatments. It was recently demonstrated that tumorigenicity, metastatic potential and resistance to chemotherapy correlated with an increased of expressed HSP70 in cancer cells. On the contrary, HSP70 depletion using combinatorial small peptides called peptide aptamers sensitizes cancer cells to die and could help in cancer therapy. The core goal of this project is to combine the latest advances of nano-optics, optical manipulation and microfluidics with the ultimate understanding of HSP70 to develop a novel integrated and ultra sensitive sensing platform for early cancer detection. An early detection would benefit to traditional but also new cancer therapies based on peptide aptamers which could be delivered sooner and at lower doses. The planned sensing device, based on surface plasmon resonances supported by micro and nano-structures, will operate in a microfluidic circuit to minimize the volumes of analytes and increase reproducibility. Enhanced and confined plasmonic fields will be engineered at the nanoscale to implement two main sensing schemes: (i) ultra sensitive tracking of HSP70 proteins in the peripheral blood based on resonance shift induced by specific protein/receptor binding, (ii) individual cell optical trapping (exploiting latest generation of plasmonics tweezers) combined with scattering imaging and Surface Enhanced Raman Scattering to monitor the concentration of HSP70 proteins at the membrane and achieve systematic cancer cell screening. These transduction mechanisms and plasmonic tweezers will be integrated into a compact platform to operate in a biological laboratory environment. Such a portable device should be seen as a precursor of a future device enabling point of care diagnostics in a medical environment and leading to individualized therapy.