M-ERA.NET Call 2015: Funded projects

Call topic	Acronym	Full Title	Nr. Partner	Funding organisations	contact details coordinator
Integrated Computational Materials Engineering	COIN DESC	Corrosion inhibition and dealloying descriptors	4	MIZS (Slovenia), FWO (Belgium), MINECO (Spain), NOW (Netherlands)	Jožef Stefan Institute, Slovenia Anton Kokalj tone.kokalj@ijs.si
New Surfaces and Coating	COLODOR	Integrated-optical detection of volatile organic compounds using functional polymer coatings	5	FFG TP (Austria), VDI-TZ (Germany)	AIT Austrian Institute of Technology GmbH Dr. Rainer Hainberger rainer.hainberger@ait.ac.at
New Surfaces and Coating	PTP+FUN	Novel Tailor made coatings for textile digital printing with pigments combining a PTP-pretreated and durable functionalities in one processing step	4	VLAIO (Belgium), NCBiR (Poland)	Dr. Patrick Hartmann phartmann@ctf2000.com
New Surfaces and Coating	FLINGO	FunctionaL Inorganic layers for Next Generation Optical devices	5	VDI-TZ (Germany), FCT (Portugal), TEKES (Finland), RCL (Lithuania)	OSRAM Opto Semiconductors GmbH Dr. Martin Strassburg martin.strassburg@osram-os.com
New Surfaces and Coating	TANDEM	Thick, adherent stress-free DLC coatings for demanding applications	6	Vinnova (Sweden), UEFISCDI (Romania), FCT (Portugal)	Uppsala University Dr. Tomas Kubart Tomas.Kubart@angstrom.uu.se
New Surfaces and Coating	GESNAPHOTO	Nano-Structured GeSn Coatings for Photonics	5	UEFISCDI (Romania), VDI-TZ (Germany)	National Institute of Materials Physics Dr. Toma Stoica toma.stoica@infim.ro
New Surfaces and Coating	CALDERA	Cost-effective Atomic Layer Deposition Processes for Large Area Coating Applications – ERA-NET	3	VLAIO (Belgium), NOW (Netherlands), Tekes (Finland)	Ghent University Prof. Dr. Christophe Detavernier christophe.detavernier@ugent.be
New Surfaces and Coating	TopCladd	Adaptive laser cladding for precise metal coating based on inline topography characterization	7	VDI-TZ (Germany), DGo6 (Berlgium)	Fraunhofer (FhG) IPT Niels König niels.koenig@ipt.fraunhofer.de
New Surfaces and Coating	LaserSTAMP	Laser and Surface Treatment Assisted Metal Polymer assembly	4	FNR (Luxembourg), DGo6 (Belgium)	University of Luxembourg Prof. Dr. Peter Plapper peter.plapper@uni.lu

New Surfaces and Coating	MASTERS	Integration of new and improved MAterials for Smart millimeTER-wave Sensors	4	Region ALPC (France), UEFISCDI (Romania)	Xlim Laboratory Dr. Laure HUITEMA laure.huitema@xlim.fr
Materials for low carbon energy technologies	NAGRALED	Semiconductor nanowire/graphene hybrids for high-efficiency light emitting diodes	6	RCN (Norway), KIAT (Korea)	Norwegian University of Science and Technology (NTNU) Prof. Dr. Helge Weman helge.weman@ntnu.no
Materials for low carbon energy technologies	SURKINOX	Designing rules for enhancing SURface KINetics in functional OXides for clean energy technologies	4	RCN (Norway), NWO (Netherlands), MINECO (Spain)	SINTEF Dr. Zuoan Li zuoan.li@sintef.no
Materials for low carbon energy technologies	NEXTGAME	Next Generation Electrodes for Anion Exchange Membrane Fuel Cells	4	RCN (Norway), MOST IL(Israel), MOST TW (Taiwan)	SINTEF Dr. Alejandro Oyarce alejandrooyarce.barnett@sintef.no
Materials for low carbon energy technologies	HarvEnPiez	Innovative nano-materials and architectures for integrated piezoelectric energy harvesting applications	5	MIZS (Slovenia), VIAA (Latvia), UEFISCDI (Romania)	Jožef Stefan Institute Dr. Marjeta Maček Kržmanc marjeta.macek@ijs.si
Materials for low carbon energy technologies	PROMISES	Pb-free Perovskite photovoltaic material screening for enhanced stability	5	VLAIO (Belgium), SERI (Switzerland)	IMEC Dr. Tom Aernouts tom.aernouts@imec.be
Materials for low carbon energy technologies	WoBaCat	Wood-based Carbon Catalysts for Low-temperature Fuel Cells	4	ETAG (Estonia), VIAA (Latvia), RCL (Lithuania)	University of Tartu Dr. Ivar Kruusenberg ivar.kruusenberg@ut.ee
Tailoring of bioactive material surface for health applications	PAIRED	Magnetically and photochemically actuated bioactive nanowires for remotely controlled drug delivery	3	MINECO (Spain), FCT (Portugal), MOST IL (Israel), SERI (Switzerland)	Fundació Institut Català de Nanociència i Nanotecnologia Dr. Borja Sepúlveda borja.sepulveda@cin2.es
Tailoring of bioactive material surface for health applications	NANOTHER	Advanced theranostic approach in cancer combining photodynamic therapy and NPs	7	FCT (Portugal), UEFISCDI (Romania), MINECO (Spain), Tübitak (Turkey)	Instituto Superior Técnico – University of Lisbon Prof. Dr. Luís Filipe Vieira Ferreira luisfilipevf@ist.utl.pt
Tailoring of bioactive material surface	SPD-BioTribo	Anti-bacterial optimization of high-strength, severe-plastic-deformed titanium	7	FFG TP (Austria), FASIE	JOANNEUM RESEARCH Forschungsges.m

for health applications		alloys for spinal implants and surgical tools		(Russian Federation), NCBiR (Poland)	.b.H., Institute of Surface Technologies and Photonics Dr. Juergen M. Lackner juergen.lackner@joanneum.at
Tailoring of bioactive material surface for health applications	Signaling implant	Implants signals to bone for bone growth and attachment	6	VIAA (Latvia), MINECO (Spain), Tekes (Finland), FFG TP (Austria)	Riga Technical University Prof. Karlis Gross
Tailoring of bioactive material surface for health applications	MediSURF	Designed nanostructured bioactive surfaces for precision medicines	4	NWO (Netherlands), MIZS (Slovenia), MINECO (Spain)	Leiden University Dr. Alexander Kros a.kros@chem.leidenuniv.nl
Tailoring of bioactive material surface for health applications	BIOHYB	Development of bio-functionalized and tribocorrosion resistant hybrid surfaces on novel Ti-based alloys	4	FCT (Portugal), MINECO (Spain), FAPESP (Brazil)	Universidade do Minho Prof. Dr. Fatih Toptan ftoptan@dem.uminho.pt

COIN DESC

COIN DESC is a basic research project targeted at (1) the design of corrosion resistant copperbased alloy systems by using corrosion inhibitors and at (2) deepening the mechanistic understanding of corrosion inhibition. The specific innovation objective of the project is to identify the physically-sound corrosion inhibition and dealloying descriptors, depending on the metallic material and environment to which the material is exposed. Such descriptors are mandatory for the construction of a new corrosion inhibitor virtual design framework which will allow a faster and more rational based screening of new specifically designed corrosion inhibitors with superior characteristics. These principle objectives will be achieved by means of an iterative learning, synergistic modelling-experimental approach pursuing the ICME-oriented paradigm, consisting of multi-scale modelling and simulation, chemical synthesis of new materials, multi-scale experimental analysis and testing, and validation.

COLODOR

Quantitative detection of volatile organic compounds (VOCs) is highly relevant for a wide range of applications. COLODOR tackles the need for compact VOC detection systems by proposing a new optical multi-parameter gas sensor concept that relies on dye doped polymers. The key objectives are:

- Research on these novel sensing materials and their local deposition on a sensor chip
- Realization of a self-contained photonic gas sensor chip
- Proof of the optical VOC sensing principle and evaluation of the sensor performance

The concept enables a small form factor, operation at room temperature and low power consumption. The project puts an emphasis on compatibility with cost-effective mass fabrication technologies to ensure a smooth transfer of the results to commercial products. This is reflected by the participation of three companies in charge of the photonic chip, the polymer deposition, and the validation of the sensing concept with respect to a cooking related target application.

PTP+FUN

Digital pigment printing of home and outdoor textiles is fast growing because of the advantages over dye-based systems such as better light fastness, less depend on type of textile and the simple printing process. Disadvantages such as reduced colour fastness and harsher handle need to be improved.

Most printed textiles require an postcoating process incorporating functionalities like fire retardant, antimicrobial or repellent properties. The objective is to develop cost-effective, sustainable Prepare-To-Print and FUNctionalized (PTP+FUN) coatings for the home, outdoor textile market in one production step. The PTP-treatment aims optimal printing performance whereas the FUN-treatment involves the incorporation of sustainable functionalities. These coatings simplify the current 4 step-processing route of (pretreatment)-(printing)-(dry/fix)-(postcoating) into a 3-step process of (pretreat+coating)-(printing)-(dry+fix) resulting in additional economic and environmental cost reductions.

FLINGO

FLINGO brings together leading representatives from academia, SMEs and industry to explore & develop various surface and coating technologies (Sol-Gel, ALD, spray pyrolysis) for LED applications. Highly transparent conductive layers for electrical contacts, inorganic matrix materials for extending the operating range of optical converters and ultrathin, chemically stable passivation layers for electrical insulation & barrier properties are key technologies enabling future optoelectronic devices. A number of promising new nanomaterials (e.g. QDs, nanorod-LEDs) are currently limited for mass production by either process constraints and operating lifetime instability. Combining such technologies with compatible coating technologies would enable these materials to be used in LED products and to extend their operating range. FLINGO aims to develop novel processes and materials for conformal deposition meeting extreme requirements in e.g. 3D LEDs & thus being compatible with mass production.

TANDEM

The specific innovation objectives of the TANDEM project are related to the development of a new generation of well-adherent and hard diamond-like carbon coatings (DLC) with good temperature stability. The novelty is in coatings combining high hardness (>40 GPa), smooth surface and low internal stress, allowing the deposition of adherent thick coatings (min. 3 μm) on metal parts with complex geometries. These combined features are especially desirable for automotive industry, in which DLC represent the largest proportion of thin film coating solutions. The benefits generated by the new DLC coatings will be: significantly improved fuel economy (protection of natural resources), reduced emissions (protection of the environment) and improved durability (lower waste and maintenance). TANDEM consortium addresses the whole chain from the synthesis of a coating to the final applications.

GESNAPHOTO

The objective of the project is manufacturing of nano-structured GeSn films for optical detection and light emission in the short-wave infrared (SWIR) range (1-3μm). The novelty of the project consist in nano-structuring of layers containing GeSn in order to create GeSn quantum dots (nano-crystals) with control of the size and Sn content, for obtaining high sensitivity. This material is a new group IV advanced coating material based on alloying Ge and Sn elements which extends the IR photonic range of Ge. The most important property is the transition into direct bandgap semiconductor for moderate Sn concentration, of critical importance for photonics of group IV semiconductors. Thus, the project deals with an alternative solution to the present III-V IR technology, a solution which is less expensive, environmentally friendly and compatible with Si technology. The IR detection has many practical applications as for example night vision, medical applications, automotive, aviation, etc.

CALDERA

ALD has proven a key enabling technology for the continuous downscaling of microelectronics. Recently, novel reactor designs have enabled the application of ALD technology outside cleanrooms, targeting large area applications in photovoltaics, flexible electronics and powder coating. However, due to the large surface area involved in these applications, precursor cost is becoming a major bottleneck for industrial upscaling of ALD in these emerging application domains. Moreover, high volume usage of the currently used ALD precursors leads to severe safety risks. Within this project, we will address these challenges by developing and validating safe, cost-effective ALD processes.

Reducing the cost of ALD processes will remove the obstacles for implementation of large area ALD at the industrial level, such that the whole value chain from equipment and material manufacturers up to the end-user applications will be able to enjoy the benefits of high quality nanocoatings deposited by ALD.

TopCladd

Functional surfaces are a key factor for quality and efficiency of products and processes. Customized surfaces can lead to e.g. enhanced resistance to abrasion and corrosion. Laser cladding presents a solution, where a laser beam melts powder or a metal wire onto a surface, leading to its functionalization. In order to secure process stability and quality in such systems, an inline process monitoring and control is indispensable. Current monitoring systems use pyrometers and cameras with limited applicability as it solely enables a temperature based control. Quantitative or qualitative information of the resultant deposition layer is not available. The objective is the development of a machine integrated process monitoring and control, based on inline geometry measurement with a customized processing head. This enables the characterization of the deposited material before, during and after its solidification. Furthermore this information will be processed and used for process control.

LaserSTAMP

Combining the very specific material properties of polymers and metals enables a variety of products with tailored properties. As metals and polymers are well known and understood, the combination of both cannot be used due to missing joining knowledge.
The objective of project LaserSTAMP is to introduce a laser based thermal welding process for hybrid polymer-metal structures. Whereas successful research projects on thermal joining of polymer-metal structures have shown the general feasibility of selected material combinations, the comprehensive scientific process understanding and explanation of the joining phenomena is still missing.
The main goal of the project is to understand the physicochemical bonding phenomena. We will investigate the impact of different surface treatments. As energy source, a brilliant laser beam source will be used. Demonstrator CNC machine will show usability in producing hybrid components for medical and automotive industry.

MASTERS

The project will focus on the integration of new and improved components with tailored properties by tuned surfaces and coatings, i.e. ferroelectric and phase change materials (PCM) inside on-chip reconfigurable millimeter-wave sensors (57 GHz to 64 GHz), while developing the concept into a marketable product. We are targeting novel devices integrating intelligent and advanced functional materials by exploiting both the agility of ferroelectric materials (permittivity change under an electric field) and the capability of PCM to transform reversibly and fast between distinct low- and high-resistivity states without need for power to maintain their existing OFF or ON state. The main objective is intended to meet the future requirements for high frequency sensors, devices and antennas with cutting-edge capabilities: reconfigurable, highly integrated, safe, efficient and low consumption. “Smaller and smarter” by cross disciplinary approach is one of the key-target addressed by the project

NAGRALED

The goal of this project is to develop high-efficiency, flexible, light emitting diodes (LEDs) using the epitaxial growth of InGaN nanowire (NW) arrays on graphene. InGaN is being widely used in commercial thin film LEDs, but as a two-dimensional (2D) film form it always requires thick, expensive single-crystalline substrates for high quality epitaxial growth. Due to the higher surface-to-volume ratio of NW structure, it can give higher light emission efficiency and it is also much more cost-efficient. Graphene is a one-atom thick hexagonal carbon crystal with record high electric and thermal conductivity as well as being transparent and very strong and flexible. Our unique concept in this project is to integrate InGaN NWs and graphene together and utilize NW’s and graphene’s innate merits to realize high-efficiency full-color LEDs that can be lightweight and flexible, posing a huge potential in future solid-state lighting and display applications.

SURKINOX

Despite excellent progress in development and manufacturing technologies of ion and mixed ion-electron conductors, fuel cells, electrolysers and gas separation membranes do not exhibit the anticipated performance. There is a need for expanding knowledge on surface exchange mechanisms, their corresponding kinetics and the relation between surface and bulk characteristics in nano-engineered materials and assemblies. The SURKINOX project will develop novel approaches to design property-driven materials with nano-functionalized surfaces and nano-structured thin films as well as necessary experimental techniques to reveal surface exchange parameters. This will have a significant technological impact by increasing system efficiency. The project benefits to academia for the generic knowledge applicable to various processes embedding catalytic reactions and to value-chain industries: powder and ceramics suppliers, technology developers and end-users (power plants, CO2 intensive industries).

NEXTGAME

The anion exchange membrane fuel cell (AEMFC) promises the use on non-platinum group metal (PGM) catalysts and therefore lower cost compared to other fuel cells. For AEMFCs to become viable options, cathode ionomer stability and anode catalyst activity must be addressed. NEXTGAME will focus on low cost material solutions to address these issues with the aim of developing complete gas diffusion electrode (GDEs). The GDEs will be optimized and validated under AEMFC operation with the goal of achieving a technology readiness level (TRL) of 4-5 for the full assembly. The innovation of NEXTGAME is that it will concentrate on the use of low-cost materials and easy-to-upscale synthesis routes to produce high performance and durable AEMFC electrodes. The project is at the edge of advanced materials research and is foreseen to contribute to breakthrough advances. The expected results will contribute to high level scientific publications and a high impact on society.

HarvEnPiez

In an era of shrinking conventional energy resources, the development of low-power-consumption portable devices, sensors and body-implantable devices, the concept of generating power by harvesting energy from the ambient environment and biomechanical movements is attracting huge interest. The most efficient way to harvest electrical energy from mechanical movements is to utilize the piezoelectricity of ferroelectrics. In the HarvEnPiez project, the influence of shape and size on the piezoelectricity of ferroelectric particles will be predicted by ab-initio calculations. Different ferroelectric particles with defined sizes and shapes of plates, cubes and/or wires will be synthesized and systematically self-assembled on a substrate for the energy-harvesting devices. A high-performance device will be developed based on the optimized composition, shape, size and orientation of the ferroelectric particles and/or the enhancement of the piezoelectricity through lattice-strain engineering.

PROMISES

PROMISES focuses on the core material of Perovskite solar cells, especially the stability and environmental nature of the end application, facilitating low cost manufacturing at ambient conditions, with two main activities:

1. Material screening to modify the two main parts of the current compound: replacing the methyl ammonium (MA) and excluding lead. High-throughput screening to identify a range of interesting materials for further detailed analysis is selected to result in advanced device realization.
2. Up-scaled processing whereby novel materials are implemented in modules with size up to 30 cm x 30 cm.

PROMISES combines two complementary research consortia with proven track record in the field: one led by imec in Flanders on material screening and selection and one led by CSEM in Switzerland on up-scaled processing. Active industrial involvement of Solaronix and the setup of specialized advisory board (AGFA, Kaneka, Oxford PV, ...) will create new economic value in Europe.

WoBaCat

The reduction of the cost of low carbon energy technologies is currently one of the most important topics in the world. For the fuel cell industry, one of the main focuses is the development of novel anode and cathode catalyst materials in both proton exchange membrane fuel cells (PEMFCs) and anion exchange membrane fuel cells (AEMFCs) instead of costly platinum. Therefore, main objective of this project is to develop novel and cost effective wood-based nanocarbon non-Pt anode and cathode catalysts for AEMFC and PEMFC application. High surface area carbon nanostructures will be synthesized from the wood, cellulose and cellulose production residues. These carbon materials will be doped with heteroatoms and modified with metal-heteroatom active centers to increase their oxygen reduction reaction activity. To enhance the hydrogen oxidation reaction activity, heteroatom doped nanocarbon catalyst will be modified with transition metal alloys decorated with small amounts of Au.

PAIRED

One of the challenges to eradicate tumors is optimizing both drug activity and delivery. Traditional passive treatments of solid tumors are limited by their lack of efficiency, specificity and off-target toxicity due to the poor penetration and non-uniform distribution of the drug inside the tumor mass. Our aim is to achieve a more efficient, spatially and temporally controlled drug delivery nanotechnology by developing innovative bioactive hybrid nanowires as advanced drug carriers that can be magnetically and photochemically actuated. The synergistic magnetic and photochemical actuation will enable guiding and triggering the release of blends of anti-cancer drugs and thermo-sensitive polymers locally inside the tumor, and generating local hyperthermia to boost the therapeutic effects. We expect that the proposed therapeutic nanotechnology will dramatically enhance tissue selectivity and penetration, thereby locally incrementing drug concentration and lethality to reduce side effects.

NANOTHER

Considering the compelling need for personalized and targeted therapy in cancer, the main objective is to design, produce and characterize new theranostic agents (polymer-coated nanoparticles with porphyrins) for photodynamic therapy. Pharmacological modulation of the endogenous antioxidant system will be used as co-therapy. Applied research for product development in preclinical setting will be complemented by advanced mechanistic studies. The project meets the M-ERA.NET topic “Tailoring of bioactive material surfaces for health applications”. The project is proposed by a multidisciplinary consortium (3 universities, 2 R&D institutes and 2 SMEs) from Portugal, Spain, Turkey and Romania, which have complementary expertise and previous cooperation. The project’s results will be disseminated by patent(s), publications and communications. The study biobank will foster research after project completion. Economic advantages will be achieved through patents and biomedical services.

SPD-BioTribo

The project goal is minimizing surgical site infections in spine surgery, which originates from transfer of bacteria during long surgeries. Bacteria lead to biofilms, causing implant loosening, pain and finally paralysis risks for the patient. Our strategy focuses both on coatings for:

(1) spinal implants with medically-optimized antibiotic drug-release from reservoirs + Ag-based long-term anti-bacterial properties against direct colonization + osteoconductivity + tribological resistance, and

(2) spinal surgery tools with long-term selective protein adsorption + anti-bacterial properties against bacteria adhesion + wear & corrosion resistance.

Further, >30-35% decreased implant and tool sizes are expected by introducing ultrahigh-strength titanium alloys for less-invasive surgeries.

Added transnational value is joining Austrian, Polish and Singaporean high-tech material & medical R&D and production knowhow, which will enable the market introduction of implants and tools in 2020.

Signaling implant

Signaling implant aims to advance orthopaedic implants, develop new manufacturing technology and introduce a new quality control method. Design of hydroxyapatite films will orient crystals and position ions within the lattice to generate a surface electrical potential, thereby imparting greater functionality compared to existing bone implants. This responds to the growing need for better osteointegration of bone implants. The effect of surface electrical potential on bacteria, bone cells and bone growth will be evaluated to determine the effect across a range of biological settings. Inclusion of technology enabling SME's into the consortium will set-out to provide both a new in-situ charging thin film technology and a new electrical field meter, with a capability of mapping the surface electrical potential. Synergy with apatite and biological testing expertise will incrementally provide a feedback loop to advance bioactive apatite and associated technologies.

MediSURF

The most versatile natural smart nanomaterials are proteins that underlay most biological functions. To this end, we propose to establish membrane-anchored polypeptide skeletons (MAPS) as a new type of a highly controlled nanoscale-bioactive surfaces with full control over functional density. We aim to rationally design those bioinspired materials from the bottom up using an interdisciplinary approach combining chemistry, biology and state-of-the-art imaging techniques, based on the expertise of this consortium. MAPS will be assembled on the surface of lipid bilayers of liposomes as well as on lipid bilayer coated mesoporous silica nanoparticles. The potential of MAPS for medical applications will be demonstrated on advanced cancer vaccines, combining targeted delivery and cellular internalization of tumour antigens, activators of immunity or anticancer drugs which will be tested in cell lines and in vivo. Effective and safe cancer vaccines are in major demand.

BIOHYB

Titanium and its alloys are the most commonly used materials in orthopaedic and dental implants. However, some major clinical concerns are still valid, namely bone resorption due to stress shielding, low tribocorrosion resistance (leading to the intense release of metallic ions and wear debris, with local and systemic harmful effects) and lack of bioactivity. The overall objective of the BIOHYB project is to find solutions to these major clinical concerns by using low Young's modulus TiNb alloys, in which tribocorrosion-resistant hybrid and bio-multifunctional surfaces will be created.

Multifunctionalized functionally graded materials (FGMs) will be developed by following two innovative and original strategies: (i) bio-FGMs having tribocorrosion resistant TiB/TiN/TiC-rich graded hybrid surfaces containing antimicrobial and bioactive agents, (ii) bio-functionalized hybrid coatings having tribocorrosion resistant TiB/TiN/TiC hybrid surfaces containing antimicrobial and bioactive agents.