M-ERA.NET Call 2016: Funded projects

Call topic	Acronym	Full Title	# Part-ner	Funding organisations
Integrated computational materials engineering (ICME)	HEAMODELL	High entropy alloys with predictable mechanical properties by computational modelling	4	NWO (Netherlands), UEFISCDI (Romania), MIZS (Slovenia)
Integrated computational materials engineering (ICME)	MuMo4PEC	Multiscale Modeling and Design of Photo-Electrochemical Interfaces	4	NOW (Netherlands), MINECO (Spain), NCN (Poland)
Innovative surfaces, coatings and interfaces	ALD4MAX	Atomic Layer Deposition For tailored bottom-top growth of MAX and MXene films	5	FCT (Portugal), EJ-GV/Innobasque (Spain), MINECO (Spain), NWO (Netherlands), NCN (Poland),
Innovative surfaces, coatings and interfaces	CellColor	Fabricating cellulose nanocomposites for structural coloration	7	RCN (Norway), FCT (Portugal)
Innovative surfaces, coatings and interfaces	CLEARPV	Transparent Perovskite Solar Cell	4	MOST TW (Taiwan), NKFIH/OTKA (Hungary), NWO (Netherlands)
Innovative surfaces, coatings and interfaces	GRAFOOD	Active GRAphene based FOOD packaging systems for a modern society	6	UEFISCDI (Romania), MIUR (Italy), MIZS (Slovenia), MINECO (Spain)
Innovative surfaces, coatings and interfaces	GreenCOAT	Green high-performance and low-friction interfaces tailored by the reactivity of novel DLC coatings and ionic liquids	3	MIZS (Slovenia), FCT (Portugal), RCN (Norway)
Innovative surfaces, coatings and interfaces	HEI-Coat	Hard Eco Innovative Coatings	5	CALABRIA (Italy), Region ALPC (France), DGo6 (Belgium)
Innovative surfaces, coatings and interfaces	INSURFCAST	Innovative Surfaces for Superalloys Casting Processes	4	MIUR (Italy), NCBiR (Poland),
Innovative surfaces, coatings and interfaces	MaSNEC	Material Synthesis in Non-Equilibrium Conditions	4	FNRS (Belgium), NKFIH/OTKA (Hungary), MINECO (Spain)
Innovative surfaces, coatings and interfaces	NESSIE	New Structured Substrates for Downstream Processing of Complex Biopharmaceuticals	5	RCN (Norway), FCT (Portugal), FFG BP (Austria)

Innovative surfaces, coatings and interfaces	NICRRE	Innovative Ni-Cr-Re coatings with enhanced corrosion and erosion resistance for high temperature applications in power generation industry	5	NCBiR (Poland), SAS (Slovakia)
Innovative surfaces, coatings and interfaces	SIOX	Engineering of silicon-oxide interface using the pulsed-laser deposition technique	3	MIZS (Slovenia), NWO (Netherlands), FNRS (Belgium)
Innovative surfaces, coatings and interfaces	TANDEM	Bactericidal hybrid surfaces against Gram-negative and Gram-positive pathogenic bacteria: Smart Tools for Wastewater Purification	3	UEFISCDI (Romania), RCN (Norway)
Innovative surfaces, coatings and interfaces	UltraGraf	Harnessing third-harmonic generation in graphene-coated optics - new devices for ultrafast pulse measurement and frequency upconversion	4	FCT (Portugal), MINECO (Spain)
Innovative surfaces, coatings and interfaces	WABASELCOAT	WAter BAsed SELective COATings for intelligent facade collectors	4	MIZS (Slovenia), RCN (Norway), RPF (Cyprus)
High performance synthetic and biobased composites	BIOFOODPACK	Biocomposite Packaging for Active Preservation of Food	7	FCT (Portugal), NCBiR (Poland), RPF (Cyprus), No Funding (Portugal)
High performance synthetic and biobased composites	COMPIO	Eco-friendly nanoclay, nanocellulose and MIP composites for microbial formulations	5	FFG TP (Austria), Tübitak (Turkey), UEFISCDI (Romania), MATIMOP (Israel)
High performance synthetic and biobased composites	HyBiCo	High performance short-fibre biobased hybrid composites for injection moulding	6	NCBiR (Poland), VIAA (Latvia), RCL (Lithuania),
High performance synthetic and biobased composites	POLYMAGIC	Biodegradable PLA composites reinforced with micro and nano Mg particles: optimisation of processing and design, and scale-up of temporary implants	5	MINECO (Spain), MIUR (Italy), FNRS (Belgium)

Functional materials	CCSRender	Energy efficient nano-modified renders with CO2-storage potential	3	RPF (Cyprus), NKFIH/OTKA (Hungary)
Functional materials	CTB Basics	CleanTechBlock - Sustainable Multi-functional Building Block Basics	3	MIZS (Slovenia), FNR (Luxembourg), ADE (Spain), FCT (Portugal)
Functional materials	GoPHy MiCO	Governing Principles in Hydration of Mixed Conducting Oxides	4	RCN (Norway), MINECO (Spain), NCN (Poland)
Functional materials	HyMatSiRen	Hybrid materials for Si surface passivation and battery applications	3	RCN (Norway), MINECO (Spain), Tübitak (Turkey)
Functional materials	MOCO3	Novel molten carbonate/ceramic composite materials for sustainable energy technologies with CO2 capture and utilization	5	RCN (Norway), NCBiR (Poland), FCT (Portugal)
Functional materials	NanoElMem	Designing new renewable nano-structured electrode and membrane materials for direct alkaline ethanol fuel cell	5	MIZS (Slovenia), RCN (Norway), MOST TW (Taiwan)
Functional materials	NEILLSBAT	Nanostructured Electrodes and Ionic Liquid Electrolytes for Ultra High Energy Density Lithium Sulfur Batteries	4	SFI (Ireland), JÜLICH (Germany), No Funding (Netherlands)
Functional materials	PLARASBAT	Planar architecture all solid state batteries	4	MINECO (Spain), RCL (Lithuania), MOST TW (Taiwan)
Functional materials	PNANO4BONE	Nanovectors engineered for plasma enhanced theranostics in regenerative medicine	6	FNR (Luxembourg), FNRS (Belgium), MINECO (Spain), NCN (Poland), No Funding (Luxembourg)
Functional materials	RATOCAT	Rational design of highly effective photocatalysts with atomic-level control	4	SFI (Ireland), NWO (Netherlands), MINECO (Spain)
Functional materials	THERMOSS	Sustainable Thermoelectric Modules based on Non-toxic Silicides and Sulphides for Recovery of Waste Heat to Power Generation	4	RPF (Cyprus), FCT (Portugal)

Interfaces between materials and biological hosts for health applications	BIOMB	Advanced biodegradable materials based on MgB2 resistant to microbial colonization	4	UEFISCDI (Romania), MIUR (Italy)
Interfaces between materials and biological hosts for health applications	BIOMEMBRANE	Bioengineered in vitro model of retinal pigmented epithelium of human eye	5	MIUR (Italy), FCT (Portugal), DST (South Africa), NCN (Poland), No Funding (Spain)
Interfaces between materials and biological hosts for health applications	INCIPIT	INtegrated Conductive and biomimetic polymeric Interfaces able to serve as micro-nanostructured Patches for myocardIal regeneraTion	4	MIUR (Italy), FCT (Portugal), FAPESP (Brazil)
Interfaces between materials and biological hosts for health applications	MagicCELLGene	Localized MAGnetIC hyperthermia CELL-based GENE therapy for immune modulation	3	MINECO (Spain), FCT (Portugal)
Interfaces between materials and biological hosts for health applications	NAT4MORE	NATural molecules on the surface of bioactive materials FOR MOdulating the host REsponse to implants	5	MIUR (Italy), RANNIS (Iceland), FAPESP (Brazil)
Interfaces between materials and biological hosts for health applications	Pelargodont	Engineering and functionalization of delivery system with Pelargonium sidoides biologically active substance on periodontal inflamed surface area	7	RCL (Lithuania), VIAA (Latvia), NCN (Poland), MIUR (Italy)
Interfaces between materials and biological hosts for health applications	SmartHyCAR	Smart multifunctional Hyaluronic Acid-Carnosine based bandages for wound care and regenerative therapy.	4	MIUR (Italy), DGo6 (Belgium)
Materials for additive manufacturing	3D-CFRP	Additive Manufacturing of Continuous Fibers Reinforced Polymer Composite Materials for High Performance Structural Applications	8	FFG TP (Austria), FASIE (Russian Federation), RCL (Lithuania),

Materials for additive manufacturing	AddiZwerk	Additive Manufacturing of Cutting Tools	8	FFG TP (Austria), JÜLICH (Germany),
Materials for additive manufacturing	BauProAddi	New construction materials and product design for additive manufacturing processes in the construction industry	7	JÜLICH (Germany), FFG TP (Austria)
Materials for additive manufacturing	BiogenInk	Biogenic Inks combining marine collagen and ionic-doped calcium phosphates for bone tissue engineering	4	FCT (Portugal), UEFISCDI (Romania), NWO (Netherlands), MINECO (Spain)
Materials for additive manufacturing	Dressing4scars	New 4D printing dressing to treat skin scars	3	FCT (Portugal), SFI (Ireland), IDEPA (Spain)
Materials for additive manufacturing	ELAM	Ultrafine eutectics by laser additive manufacturing	7	JÜLICH (Germany), MINECO (Spain), NKFIH/OTKA (Hungary)
Materials for additive manufacturing	HiPA²I	High Performance Additive manufacturing of Aluminium alloys	5	FFG TP (Austria), FCT (Portugal)
Materials for additive manufacturing	jawIMPLANT	Patient-specific bioactive, antimicrobial PLA-PGA/titanium implants for large jawbone defects after tumour resection	8	FFG TP (Austria), NCBiR (Poland),

HEAMODELL

High entropy alloys (HEA) are recently developed metallic materials, composed of five or more principal elements, which feature high mechanical and oxidation resistance properties at elevated temperatures. The complexity of HEA inherent to the large number of possible elemental combinations represents a serious challenge for industrial implementation. HEAMODELL project is proposing to establish new thermodynamic and kinetic criteria based on composition-solidification-heat treatment-structure correlations, making use of electronic, atomistic and macro-scale modelling techniques, coupled with a focused experimental and characterisation approach. The integrated multiscale model for HEA design is validated at laboratory level including alloy synthesis/processing at pilot scale. Project results will contribute to the improvement of ICME predictive power for high temperature alloys for jet engines and to shorter time-to-market for innovative materials with high market impact.

MuMo4PEC

We propose an innovative, multi-scale modeling and simulation approach in order to investigate photo-electrochemical (PEC) interfaces. This will pave the way towards targeted design and fabrication of PEC interfaces with advanced properties and performance. It is the first time that four levels of theory from atomistic to continuum level are combined for PEC interfaces and that electrochemical data will be simulated that can be directly compared to experimental data. Hence, we bridge theory and experiment. The kinetic parameters (intrinsic and extrinsic) as well as the structure and the dynamics of the solid-liquid interface will be determined. This will result in the identification of the limiting reaction steps at the interface which will allow for tailored design of photoelectrodes. We focus on the Fe_2O_3–water system due to its abundance, costs, and PEC properties, but also because of its benchmark character. The approach can be transferred to other electrochemical interfaces.

ALD4MAX

ALD4MAX will tackle the deposition of MAX phases and MXenes by Atomic Layer Deposition (ALD). MAX phases are ternary carbides and nitrides with specific stoichiometry and layered structure which show very interesting properties. MXenes are 2D systems equivalent to graphene which result from the elimination of the element ‘A’ from the MAX phase.
There is no simple approach to deposit MAX phases on conventional substrates; e.g. heating at high temperatures is needed, which is inviable in many cases. Moreover, MXenes are only prepared in bulk form by chemical etching of the MAX phase, but the deposition of individual MXene is not reported.
In ALD4MAX we will take benefit of the layer-by-layer growth characteristic of ALD to deposit MAX phases and MXenes with high control, and also ‘mixed’ MAX phases by stacking different types of MAX phases. ALD4MAX will generate a high impact, since not only a new class of materials will be prepared, but also new possibilities for ALD will be proven.

CellColor

The aim of the project is to develop original, environmentally friendly, nano-structured surfaces and coatings with engineered optical functionality for coloration and reflection of light. The surfaces and coatings will be fabricated from cost effective natural materials like cellulose, and will allow for environmentally friendly energy control and improved energy efficiency, thus providing innovative technology for future delsign or architecture, beyond the lifetime of the project. The project is coordinated from the Norwegian University of Science and Technology (NTNU) in Trondheim Norway, and the partners representing the various academic and industrial areas are: In Norway: Institute for Energy Technology (IFE) in Kjeller, the SME Giamag Technologies, the large industrial company Borregaard AS, and the design and architectural firm Snøhetta Oslo AS. From Portugal the partners are: NOVA.id:FCT and Instituto Superior Tecnico (IST-ID), both in Lisbon.

CLEARPV

We are proposing to develop large-area semi-transparent 6 inch durable perovskite photovoltaic modules with power conversion efficiency (PCE) over 13%. The modules can be directly used as building units. Moreover, they can be stacked with silicon solar cells for an expected PCE over 18% and approaching 25%. The program considers the materials and processing aspects of the new perovskite PV technology aiming for energy efficient process approach of low temperature.

GRAFOOD

GRAFOOD aims to develop a pilot-scale prototype of active food package based on paper and polylactic acid (PLA) film respectively, modified with graphene oxide activated by probiotics and by nano-Ag-TiO_2, respectively. Specific objectives: ● characterize the packages currently used for cheese and meat storage; ● design, characterize and validate the prototype of active packages; ● start the procedure to homologate the most efficient PLA and paper based active package and to obtain the Romanian and European patents. The result is a pilot-scale prototype of active package based on paper and PLA film, respectively. The project has multi-lateral impact for academic research teams and their universities, environment and society. Economic benefits: ● reducing the costs for the processing of unsold goods; ● diminishing the amount of the food waste and the costs for their processing, thus increasing the financial profit. The evolution of TRL during the GRAFOOD proposal is from TRL 1 to TRL 7.

GreenCOAT

The GreenCOAT project will design a new type of green, DLC-coated interface based on an innovative DLC-deposition technology, tailored for operation with harmless ionic liquids (IL) lubrication. This will comply with restrictions relating to greenhouse-gas emissions that will soon be demanded for all heavily loaded, lubricated mechanical components in transportation and industrial systems. Current UN, EU and national emission legislation already restricted the use of today's key lubricants, for which there are no acceptable alternatives available. This means that if a new green interface lubrication is not developed in near future, the performance of machinery will rapidly deteriorate, leading to massive technical, economic and social consequences.
The GreenCOAT project is about developing innovative “green” DLC-IL interface, which will be full-scale validated for heavy-duty fluid-power hydraulics systems.

HEI-Coat

Hard Chrome (HC) coatings for anticorrosion and anti-wear applications cover a wide market share ranging from automotive to aerospace. To date, HC electrolytic plating, used for more than seventy years for engineering applications, has dominated the wear coatings market, because of its simple and cheap coating method.
Unfortunately, hexavalent Cr(VI) in the electrolytic baths is toxic and carcinogenic, and the overall deposition process itself is highly risky for both workers' health and environment. For that reason, according to the Regulation (EC) No 1907/2006, by 2017 the production of HC with Cr(VI) baths will be banned. It is then mandatory to find alternative materials and/or methodologies of deposition.
The HEI-Coat project aims at developing innovative coatings deposited by the environmental friendly Cold Gas Spray technique or by the more conventional Electroplating Technology, with functional properties similar or better to the ones presented by HC.

INSURFCAST

INSURFCAST aims at finding new solutions for precision investment casting processes of complex-shaped superalloy blades, through the understanding of the solid-liquid phenomena occurring at the alloy-mould interface leading to the design, engineering and application of innovative mould surfaces. The innovation objective is the reduction of expensive operations of finishing after casting, and blades rejections or failure. Successfully meeting these objectives involves Italian and Polish research laboratories using advanced experimental and theoretical methods, in strict synergy and interaction with the metal casting industry. These innovative results will be obtained through specific wetting tests, microstructural and microchemical characterization of surfaces and interfaces as well as by thermodynamic modelling of the reactivity in selected alloy-ceramic coating systems. Technological trials and post-processing analysis of castings and moulds will lead to optimized casting processes.

MaSNEC

The MaSNEC project aims to grow innovative surfaces and control their properties via material synthesis in non-equilibrium conditions. The innovation will be to obtain solid material by precipitation reactions performed within diffusive gradients of concentration and convective flows due to injection of one reactant into the other. We will provide new protocols taking advantage of imposed out-of-equilibrium constraints to synthesize thermodynamically unstable solid polymorphs, manufacture nanoparticles and structured surfaces, composite coatings and multilayered tubes. By defining an innovative procedure to structure and create new solid materials, this project proposes a paradigmatic shift in surface and coating technology to produce innovative materials with targeted relationships between their micro and macrostructures. The novel concept will impact material sciences and provide new routes to synthetize materials for societal and environmental applications.

NESSIE

Virus-like particles (VLPs) and viral vectors (VVs) are revolutionizing medicine by offering targeted vaccines. Production of VLPs and VVs is costly and time consuming because purification by chromatography, the state-of-the-art technique, has drawbacks that limit its performance.
We will develop novel targeted surface-modified chromatographic materials for purification of these complex biopharmaceuticals. Structured monoliths will be produced by post-modification of shapes produced by additive manufacturing (AM). We will use ceramic-based AM techniques with ~150 □m resolution to produce mechanically stable isoreticular monoliths for downstream processing of clarified bioreaction bulks of adenoviruses and retro-VLPs as model cases. With new materials and using AM techniques applied also to design the flow distributors, we aim to precisely control the purification unit. We will also design novel continuous chromatographic methods to reduce time lags and thus production cost.

NICRRE

The main objective of the NICRRE project is to develop new coatings for steel combustion boilers in power generation plants and to identify technically suitable and cost effective techniques of their deposition. These coatings should mitigate corrosion and erosion in boiler’s piping and increase its operating temperature. Two innovative material solutions are proposed: NiCrRe and NiCrRe/Al2O3 coatings to be deposited by plasma spraying, high velocity oxygen fuel spraying, and direct laser deposition. The project will encompass coatings development, characterization of microstructure and properties, modelling, fabrication and testing of demonstrators in a real combustion boiler. The most important innovation originating from this project will be a new thin coating technology for boilers (target thickness of 1 mm). It will result in an extension of boiler’s inter-haul intervals, cost reduction of regular inspections, increase of electric energy and heat production.

SIOX

SIOX aims to exploit the rich functionalities of oxides and their heterostructures, which show great promise within the emerging field of oxide electronics. For their implementation, epitaxial integration of oxides with silicon platforms using industrially appropriate technology is urgently needed, and its development represents the main goal of SIOX. However, such succesfull integration is extremelly delicate due to materials` intrinsic incompatibility. This challange will be addrressed by collaboration between three research groups, with experties in theoretical modelling, atomically-controlled growth and materials` applications. The project has two objectives: to prepare high-quality oxides on silicon by understanding corresponding interface phenomena, and to functionalize as-prepared layers with functional heterostructures. Protocol for successful integration represents the main result of the project, which is heralded as the next step in the development of forthcoming electronics.

TANDEM

After major efforts for hygienize the wastewaters, the presence of pathogenic bacteria is still detected in the water, soils and even crops, causing public and environmental hazards. This issue is of high concern as most pathogens responsible for waterborne diseases originate from faecal or food waste contamination caused by insufficient- or not treated wastewater. As a result, TANDEM project focuses on developing innovative and efficient bactericidal hybrid surfaces for Gram-negative and Gram-positive bacteria that can be transposed into special building blocks (i.e. "smart tools") for creating more efficient bio-tanks and sustainable wastewater purification technologies with regard to pathogenic bacteria removal. The project consortium is well-balanced having aside two renowned R&TD entities from Romania and Norway that will guaranty the successful implementation of the project. In addition, one medium enterprise from Romania is entrusted with prototyping/testing the tandem bio-tank.

UltraGraf

Ultrafast lasers have many important applications in physics, materials processing, chemistry, biology and medicine. Their pulses are among the shortest events ever produced, with durations reaching the few femtosecond regime (1 fs = 10-15 s). Nevertheless, the lack of adequate temporal measurement and control tools has hampered their migration out of the laboratory and into mainstream applications. This project directly addresses these challenges by developing and demonstrating a new and universal ultrafast pulse measurement and control device, where the dispersion-scan technique is combined with the exceptionally broad bandwidth and high conversion efficiency of nonlinear third-harmonic generation (THG) in graphene coatings. This technology is highly performing, easy to use and applicable to an unprecedentedly wide range of laser systems, which should enable new scientific, industrial and medical applications of ultrafast lasers and contribute to the growth of the ultrafast market.

WABASELCOAT

Solar absorbers incorporated in façades systems become a reality in the modern architecture, although they do not fulfil completely the demands of costumers. In this respect coloured spectrally selective paint coatings are required. Water-borne thickness insensitive spectrally selective coatings with anti-soiling effect are one of the optimal choices since they offers the possibility of achieving high solar to thermal conversion efficiency, longevity and high aesthetic demands of architects. At present, the practical use is faced with three major problems: i) nonselective coatings are used for increase the absorptivity, ii) coatings are made by solvent-borne resins, high volatile organic solvents (VOC)emission and iii) the dust and dirt are collected on the absorber surface resulting in decreased efficiency. The effectiveness can be improved using black or coloured spectrally selective inorganic and metallic pigments incorporated in water-borne resins with low thermal emittance result.

BIOFOODPACK

BIOFOODPACK aims to develop a sustainable biocomposite food packaging material to actively interact with foodstuffs, leading to improved food safety with minimal processing, reducing food loss and waste. Antimicrobial and antioxidant properties of natural resources are combined with different fillers to achieve water resistant materials with enhanced mechanical and gas barrier properties and electrically conductive for in-pack sterilization by pulsed electric fields.
BIOFOODPACK will provide a food packaging material based on abundant recyclable and biodegradable biopolymers,, which will actively protect food with reduction of food waste, a huge

nowadays problem. The implementation of packaged food sterilized at low temperature will extend shelf-life, maintaining organoleptic and nutritional characteristics of fresh food. A multidisciplinary team will work interactively to generate innovation and market exploitable products.

COMPIO

In COMPIO we will develop both synthetic and biobased high performance composites for microbial formulations:
• Based on molecularly imprinted polymers (MIPs)
• Based on nanoclay
• Implementing nano crystalline cellulose as carrier, natural filler and dispersion agent
The integration of these types of composites will
• provide clearly enhanced water vapour and O2 barrier properties
• significantly improve mechanical strength and reduce abrasion
• protect beneficial microbes from UV-radiation damage
• enhance shelf life
This project will make its principal impact in development of sustainable materials and processes for the highly requested field of biocontrol addressing the market of large-scale plant cultures (maize, tomato sunflower).
COMPIO is expected to support current research efforts of the consortium (AIT, PPIMC, AGLYCON, Simbiyotek, Melodea) and generate strong input for the company partners opening up new business segments and application fields.

HyBiCo

The project aims at developing novel highly biobased short-fibre hybrid composites for injection moulding applications meeting a demand for high-performance lightweight materials. In order to achieve high specific mechanical properties PP and bio-PE matrices will be reinforced with man-made cellulose and r-PET/bio-PET fibres. Their hybridisation and tailoring of their fibre-matrix interfaces will provide excellence in impact behaviour. To reduce costs, as well as to increase of biobased content a hybridisation with wood flour and lignocellulose microfibres obtained from grain husks will be applied. The synergistic effects, which have already been observed, will be used to attain the relatively high mechanical performance of these hybrids. Manufacturing by one-step compounding will provide high efficiency at possibly lowest cost. The project will open the possibility to implement developed short-fibre hybrid composites in small and medium enterprises in plastic industry.

POLYMAGIC

The project proposes the optimisation and scaling-up of biodegradable and bioabsorbable composites for osteosynthesis based on a polylactic acid (PLA) matrix loaded with Mg particles in the nano and micrometric range, and processed by thermoplastic methods. Other innovative objectives are related to their processing by a colloidal suspension route to increase homogeneity and particle-matrix bonding, as well as by additive manufacture and electrospinning. The project also considers the sustainability of the whole life cycle of the proposed materials and processing. Potential benefits are related to better mechanical properties, increased bioactivity and antibacterial resistance, and possibility of tailoring degradability of implants by controlling shape and volume fraction of Mg (nano)filler. These temporary implants would improve life quality of patients, especially paediatric, and would open new business opportunities, guaranteed by the two participating SMEs.

CCSRender

This proposal aims at producing novel, environmentally-friendly, lime-based renders with the ability to master CO_2 sequestration via in situ mineral carbonation. This will be achieved through the addition of suitable ophiolitic/volcanic materials (including quarry wastes) in nano-scale to the aforementioned composites, following the application of ball milling. These additives have significant CO_2 uptake potential and will thus (i) contribute to the mitigation of CO_2 concentrations in the atmosphere, and (ii) accelerate the carbonation reaction kinetics, thus improving the physico-mechanical properties of the end-products. It is anticipated that this proposal will succeed at producing innovative prototype building materials, which will be suitable for renovation/conservation and contemporary sustainable architectural projects. The outcomes of the project will lead to concrete solutions to real-life problems that will generate economic, environmental and societal benefits.

CTB Basics

CleanTechBlock (CTB) is a multifunctional, sandwich-block solution with integrated thermal insulation. The CTB concept improves the superior insulation material – foam glass –, and combines it with the durability of traditional masonry. CTB results in great environmental and economic benefits, originating from a decrease in CO_2 emissions and energy required for production and transportation, the large amounts of waste materials used in the production, the prolonged service life, minimal use of cement, faster construction, and the full recyclability of CTB components. The objectives of the proposed project are to develop and experimentally validate a model of the heat-transfer in order to identify further possibilities to decrease the thermal conductivity of foam glass, to prepare a model of heat and moisture transfer for optimization of the CTB structure, and to perform a life cycle assessment of the CTB solution in order to reveal and quantify the sustainability of the CTB concept.

GoPHy MiCO

GoPHy MiCO addresses one of the main challenges in the development of new efficient energy systems based on Proton Ceramic Fuel Cells and Electrolysers, namely the identification of ceramics with mixed protonic and electronic conductivity. These are essential for the oxygen/steam electrodes, but only few and mediocre ones are identified. By systematically studying a set of double perovskites with different cations on distinguishable A-sites, and by systematic substitutions of these and also the B-site cation, trends in structures, oxidation, and hydration behaviour and conductivity will be established. The project outcome will potentially bring significant contributions to the ongoing implementation of hydrogen energy systems. Methodology to be employed comprises Neutron Powder Diffraction, electrochemical methods impedance spectroscopy, thermogravimetry, and ab initio atomistic modelling. Partners are UiO and IFE (NO), GUT (PL) and ITQ/CSIC (ES).

HyMatSiRen

Hybridization of organic and inorganic compounds allows to tune functionality of materials. Main focus of the project is synthesis and characterization of new hybrid materials obtained by incorporating inorganic nanomaterials into polymers. Functionality of the material will be tuned for applications in photovoltaics and Li-ion batteries. This is a multidisciplinary project combining expertize of specialists from different fields such as materials science and nanotechnology, photovoltaic technology, Li-ion batteries, physicists, chemists, and engineers. The consortium consists of experts from an education- and basic research-oriented University from Spain, an applied research Institution from Norway, and a small & medium enterprise from Turkey. It will form the platform for further enhancing the ongoing collaboration, provide training of young scientists, exchange of infrastructure, new ideas, competence and impact in applications. An increase in TRL from 3 to 5 is foreseen.

MOCO3

The MOCO3 project focuses on the development of novel composite materials consisting of molten carbonates infiltrated in a solid matrix as functional materials in intermediate temperature fuel cells and CO2 selective membranes. MOCO3 addresses performance and lifetime of these systems by focusing on materials engineering at all length scales (atomistic, micro- and macroscopic) guided by synergetic combination of experimental research and advanced numerical simulations for driving materials design. The MOCO3 project will last 3 years, starting at TRL3 and ending at TRL4. It is coordinated by SINTEF in collaboration with University of Oslo (NO), Warsaw University of Technology (PL), one high-tech SME CIM-mes Projekt (PL) and University of Aveiro (PT). The project will educate 2 PhD and train 3 post-doctoral candidates. It fosters intensive dissemination by various academic and popular channels and involves an advisory board with materials suppliers, technology developers and end-users.

NanoElMem

The increased demand for energy, coupled with concerns about environmental pollution and growing fossil fuel costs have created a great need for clean and efficient power sources. Fuel cells directly convert chemical energy stored in fuels into electrical energy through electrochemical reactions, and have been identified as one of the most promising technologies for the clean energy industry of the future. The overall concept of the NanoElMem project relates to developing novel stable and highly effective materials for the direct alkaline ethanol fuel cell (DAEFC), which directly converts ethanol to electric power. The enhancement of the performance of DAEFCs is based on the development of platinum (Pt)-free electrode catalysts and nano-composite membranes by using environmental-friendly inorganic and polysaccharide materials and technologies. The enormous technical and scientific potential of graphene will be explored in producing of new graphene-polysaccharide membranes.

NEILLSBAT

The proposal seeks to overcome the limitations of Lithium sulfur batteries (LSB) through the development of safe high-capacity anodes based on silicon and germanium nanowire heterostructure arrays and specifically designed high-capacity MOF-S (Metal Organic Frameworks with sulphur in pores) cathodes in addition to safe non-flammable ionic liquid electrolytes. The ultimate goal of the research is to produce a full LSB based on these components with a specific energy of 600 Wh/kg for at least 100 cycles. In this approach, aimed at Topic 4 Functional Materials section 4 Energy Storage, we intend not just to synthesise these high performance electrode materials, but also to achieve a detailed understanding of their structural and chemical evolution during battery cycling, with a view to their further modification and optimisation. The developments the partners have carried out to-date in these areas are at TRL 4 and at the end of the project the developments will be at TRL6.

PLARASBAT

The all-solid-state lithium ion batteries is a long-sought target. They will have a wider operating temperature range and are safer than liquid electrolyte based counterparts. A large area sheet-like all solid state batteries (ASSB) innovative architecture is proposed. The “electrolyte supported” architecture thick-film battery is based on controlled deposition of electrodes onto a solid electrolyte thick film. Impact is expected as the batteries will be lighter, slightly flexible and compatible with large area electronics and flexible electronics devices. ASSBs can be used in wider temperature range, opening their use in harsh environments. The innovative ASSB architecture will provide quality energy storage in applications still no envisaged opening new markets. New knowledge will be produced in solid state electrochemistry and ceramic technology. The societal benefits are many, they do not use pollutant organic electrolytes, use less metals and are safer.

PNANO4BONE

Current scaffolds for regenerative medicine are facing several drawbacks, which are the low proliferation of living cells seeded in the implant, the short duration of drug delivery when drugs are embedded in the scaffold and the impossibility to easily follow the regenerative processes once the scaffold is implanted.
The objective of the project is to solve the above mentioned drawbacks by embedding specifically designed nanovectors in the scaffold. The interaction of these nanovectors with tissue-tolerable plasma (ionized gas) will allow promoting the living cell proliferation through the generation of reactive species. The inorganic core of the nanovectors will allow the drug release over weeks/months. The probes loaded in the nanovectors will allow monitoring the regenerative process with non-invasive imaging technologies. If successful in the context of bone regeneration, this approach could be easily adapted to the regeneration of other tissues and lead to lower therapies' costs.

RATOCAT

Using the sun's energy to generate hydrogen from water is probably the cleanest and most sustainable source of fuel that we can envisage. Unfortunately, catalysts that do this are currently too expensive to be commercially viable. The RATOCAT project aims to develop improved photocatalyst materials, along with the processes for their production. The catalytic performance of cheap TiO_2 and C_3N_4 powders will be improved by tailoring their surface with nanostructured oxides as co-catalysts of highly-controlled composition, nanoarchitecture, size and chemical state. First principles simulations will be used to design the optimum nanostructures, which will then be deposited onto powders with the required precision using atomic layer deposition, again supported by simulation. Lab-scale tests of photocatalytic activity will provide feedback for the optimisation of the material and process, before the most promising materials are tested in the field on both pure water and wastewater.

THERMOSS

The core concept of this proposal is to develop and deliver new energy harvesting thermoelectric materials and modules based on n-Mg_2X(X:Si,Sn) and p-$Cu_{12-x}(Co,Ni,Zn)_xSb_4S_{13-z}Se_z$ systems. These systems are advantageous, exhibiting many attractive characteristics, such as: (i) high ZT (≥ 1.0), (ii) operational in a medium temperature range, important for waste heat recovery, (iii) made from widely-available pure materials with large EU supply chains, (iv) low raw material cost, (v) are nontoxic. Focus will be put on the materials/modules design/synthesis, optimization, properties and characterization as well as the investigation of possible applications. Specific research objectives are (a) optimized synthesis of cost-effective highly efficient TE materials with ZT ≥ 1.0 at 350˚C; (b) modeling of modules and development of a prototype; (d) explore potential applications (cement industry and automotive).

BIOMB

The innovation of this project consists in the evaluation for the first time of the MgB_2 potential for bio-medical applications, although it is currently produced for superconductivity devices. Expectations are to generate new MgB_2-based composite multifunctional biomaterials with antimicrobial/antifouling properties, and an increased biocompatibility at interfaces between the material and the biological media. The MgB_2 powders, coatings and bulks could be used in biodegradable implants or drug delivery systems, handles and surgical tools, catheters, wound dressings and so on. The mechanical and physico-chemical properties of the proposed materials will be investigated by a comprehensive approach, and bio-evaluation will include in vitro and in vivo assays. The MgB2 materials are viewed as solutions for space- and time- scale controlled variation of the functional properties required for different bio-applications.

BIOMEMBRANE

Age-Related Macular Degeneration (AMD) is the leading cause of blindness in the elderly worldwide: although it does not cause total blindness, there is a progressive loss of high-acuity vision attributable to degenerative and neovascular changes in the macula. Currently, there is neither a cure nor a means to prevent AMD. The main objective of BIOMEMBRANE project is the design and fabrication of an alternative and smart in vitro model of retinal pigmented epithelium interfaced to the choroidal vascular network with an engineered Bruch's membrane (the blood-retinal barrier) to boost the discovery of new therapeutic strategies for AMD. BIOMEMBRANE project will have an important impact on health care costs and will render the European biomaterials, pharmaceutical and biotechnological industries more productive and dynamic, developing an economic in vitro testing system, which will be compliant with regulatory issues and with stringent pre-clinical testing requirements.

INCIPIT

The leading cause of death for cardiovascular disease is coronary heart disease. Current therapies do not restore the functionality of damaged myocardial tissue. The only effective therapeutic intervention is an approach able to stimulate the autonomous regeneration of myocardium. Recently, we developed bioartificial scaffolds with the potential to serve as acellular patches for in vivo cardiac regeneration. Herein, the patch will be implemented with electroconductive polymers in order to improve cardiac commitment. The protection against ventricular remodelling and recruitment of stem cells in situ will be pursued through the use of advanced nanotechnologies. The therapeutic product will be validated in vitro using stem and precursor cells, induced pluripotent stem cells, organotypic heart cultures and in vivo using a small animal model. The INCIPIT cardiac patch technology will move this material-based product closer to the market of smart therapies in the cardiovascular field.

MagicCELLGene

The goal of MagicCELLGene is to develop a novel, universal and highly efficient methodology for transfection triggered by magnetic hyperthermia, with potential clinical applications in cell-based gene therapy. Our innovative approach is to induce a controlled and localized heating of the cellular membrane (hotspots) using magnetic nanoparticles covalently immobilized onto cell membranes via bioorthogonal chemistry; the reversible changes of the cell membrane permeability/fluidity will be used to promote the artificial delivery of nucleic acids into cells. Efforts will be especially focused on hard-to-transfect cells (primary cells), thus clearly addressing an unmet need of the transfection market. Expected results going beyond the state-of-the-art in transfection are: i) the development of a universal transfection tool and ii) its application to systems where standard transfection methods have several bottlenecks using as a model immune system modulation.

NAT4MORE

Innovation objective: physiological healing of bone implants (modulation of host response).
Unmet need: inadequate long-term outcome and infections of implants.

Specific objectives: scientific understanding of the implant-tissue interface (inflammation, osteoblast/osteoclast balanced activity, biofilm formation); bioinspired surface functionalization; industrial processing (stability of grafted biomolecules after packaging, sterilization and storage).
Expected results: up-scaled protocols of extraction and selection of natural biomolecules (polyphenols, chitin derivatives), optimized functionalization processes of bioactive glasses, hydroxyapatite, titanium alloy with biomolecules in active state and proper amount (quality control), assessment of post-processing steps.
Impact and benefits: exploitation of granted patents, enhanced functionality of implants, benefits for patients health, new commercial products and markets for the involved SMEs, reduction of hospitalization time/costs.

Pelargodont

Periodontitis treatment include use of antibiotics and synthetic antiseptics that is accompanied by systemic side effects and increased bacterial resistance. Such strategy is not suitable for prolonged or repeatable treatment and fails to stop disease remission and further progression. This creates a demand for local delivery devices with multiple antibacterials of mild action. The aim of the project is to engineer a biodegradable mucoadhesive drug delivery system of local action with natural active substance for periodontitis treatment. The system will be designed to release optimized levels of multiple antibacterials from Pelargonium sidoides root extract in the disease-affected area for a sustained period of time aiming for both ease of use and high patient acceptance. The project will deliver an innovative product that will help to avoid or delay surgical treatment, prevent side effects, bacterial resistance, reduce the number of severe cases and decrease societal medical costs.

SmartHyCAR

An emerging approach for care and regenerative therapy of chronic wounds, which have an increased incidence in elderly, diabetics, immuno-suppressed and immobilised people, uses smart hydrogels for a spatio-temporally triggerred repair process. Hyaluronic acid (HyA)-based dressings are already safely used, e.g., in treating diabetic foot ulcer. The novel multifunctional HyA-CAR(GHK)-Cu dressing, deposited via an atmospheric plasma technology ad hoc designed and developed, starts from HyA conjugated with a dipeptide (carnosine, CAR) and/or a tripeptide (GHK), exhibiting inhibitory effects against carnosinase as well as antioxidant and anti-inflammatory properties. The scaffold is further implemented by the incorporation of copper, which has angiogenic and antibacterial properties, as well as SOD-like activity in the CAR-Cu and GHK-Cu complexes. The HyA-CAR(GHK)-Cu hydrogels will provide a novel unique synergic activity in the modulation of the wound healing and scar repair actions.

3D-CFRP

The ambition of the proposed research is to bring together two important aspects of lightweight design and manufacturing: fused filament fabrication based additive manufacturing, and continuous fiber reinforced polymers for structural applications. In this way, the inherent advantages of the two components of the value chain (material and manufacturing) can be combined in order to obtain competitive structural components even lower production costs, in a flexible digital environment that allows rapid design changes in accordance with the requirements of a more and more dynamic market. The project aims to address all aspects and stages of the composite 3D printed material development, starting with the compatibility between the fiber and polymer matrix constituents, manufacturing and optimization of the input filament to the 3D printer, development and optimization of the specialized 3D printer head and whole 3D printer system, process simulation, , material and structural testing.

AddiZwerk

Manufacturers of cutting tools are facing challenges to develop more efficient tools. Their efforts are hampered by traditional production methods and technologies. Traditional technologies (e.g. milling) follow a line of sight principle and face restrictions concerning geometry features, especially in terms of internal geometries. Additionally, these methods require elaborate setup processes to produce small batch sizes and cutting tool prototypes, which leads to an increasing time to market. An approach to overcome these impediments is the application of additive manufacturing (AM). AddiZwerk aims at enabling AM of cutting tools by qualifying cemented carbide and ceramic materials for additive processes and by developing innovative tool features that take advantage of AM's freeform fabrication approach. By additively generating cutting tools and applying them in machining experiments, the qualification of AM tools in comparison to traditional cutting tools will be determined.

BauProAddi

The project aims development of innovative, printable building materials for enhanced quality and a fast production process, which can be applied for additive manufacturing in construction practices. A material- and requirement-related new process technology for processing the materials is provided. Through cooperation between companies, universities and research institutes throughout the value chain, an innovative automated, fast, flexible and precise material and technology for 3D printing in construction is created, which significantly stands out from the state of the art. However, the current advances in 3D printing are not practical in construction industry because of the compatibility limitations of traditional building materials such as rheology, setting and hardening with 3D printing process. Thus, new construction materials will be developed and tested with customized additive manufacturing processes and demonstrators in the order of 1-2 m^3 will be produced.

BiogenInk

BiogenInk aims the development of bioinspired and bioresorbable inks for additive manufacturing, composed of marine collagen and ionic-doped calcium phosphates, as building blocks for the production of advanced scaffolds towards bone regeneration, promoting innovation in health sector, mainly on orthopaedic therapies. It is pretended to establish a sustainable and eco-friendly raw materials pipeline, including the production of a novel biological collagen crosslinker from a combined bioremediation strategy, which specific formulations mimics bone tissue composition. These printing materials will be further used to develop functional scaffolds, based in real clinical cases, recapitulating the complexity of bone structures obtained through a reverse engineering approach. A simple and standardized procedure from acquisition of imaging data to the production of patient case-specific biomaterials by 3D printing will be established, with potential to be successfully translated into clinics.

Dressing4scars

Additive manufacturing (AM) has been highlighted as a key technology with huge potential in different sectors. While AM technologies have been considering only the initial state of the printed object, assuming that it is static and inanimate, a new concept, 4D bioprinting, in which "time" is integrated as the fourth dimension has recently emerged. Time is not related to the duration of the printing, but rather to the fact that the printed products continue to evolve over time acting as smart responsive scaffolds.

The development of new customized dressings capable of responding to skin wound biomechanics represents a major challenge but also a disruptive approach to treat scars and minimize scarring during healing. Thus, Dressing4scars aims to cover that niche by following a "4D printing" approach to develop smart responsive skin dressings that are capable of changing “shape/mechanical cues” while new skin is being formed, counteracting the pro-scarring mechanical forces.

ELAM

The proposed project aims at developing new high strength eutectic alloys by laser-based additive layer manufacturing (ALM) using selective laser melting and laser metal deposition based on Ti-TiFe and Fe-Fe2Ti eutectics. These laser-based ALM methods possess inherently high cooling rates and are, thus, ideal for processing ultrafine eutectics and hierarchically structured near-eutectic alloys including Ti-Fe-Sn-Nb, Ti-Fe-Co, Fe-Ti-Si, Fe-Ti-Zr-B and other eutectic alloys. Although being the subject of research for decades and showing remarkable mechanical properties, none of these alloys is currently relevant for industrial applications since no economically and technically viable processing route exists. This proposal represents the first attempt to produce ultrafine Ti- and Fe-eutectics by ALM, spanning activities along the entire manufacturing chain from fundamental materials development, powder production, ALM process and post-treatment developments to demonstrator testing.

HiPA^{2}I

The proposed project focuses on the design of new Aluminium alloys purpose-made for Additive Manufacturing (AM) processes, especially in kind of welding wires for building parts and components layer by layer. Within HiPA^{2}I innovative Aluminium alloys designed for use in wire-based AM processes shall be developed. The novelty shall include a beneficial set of superior properties in strength, elongation and corrosion resistance. Since these material will build up the whole generated parts, any weaknesses in Aluminium welding will be reduced. The outlook on reduced costs for AM parts is mainly based on the high deposition rates of wire based welding processes. The novelty would be an AM custom made wire! The expected impact includes new wires developed to enhance performance, efficiency and productivity including an in-depth understanding of metallurgical evolution of alloys from feedstock to parts.

jawIMPLANT

Surgical excision of maxillofacial (jaw) tumours generally leads for annually ~5500 patients in EU28 to scarred, mangled facial appearance and the loss of mastication and speaking functions. Current gold standard for reconstruction of the large bone defects is transplantation of autologous vascularized bone, being still strongly constrictive by limited transplantable bone, low surgical accuracy and risk of tissue necrosis in subsequent high-dose anti-cancer chemo-/radiotherapy.
Consequently, our focus is an alternative treatment, separating immediate reconstruction after tumour resection for such high-dose anti-cancer therapy (ongoing R&D), and final reconstruction by patient-specific manufactured maxillofacial implants (R&D target of this project). Planned unique implant features are a durable metal core for tooth crowns and jaw-joint fixation and an anti-bacterial coated biodegradable polymer shell, being replaced by new bone due to local drug-delivery within ~12 months.