M-ERA.NET Call 2017:
List of projects recommended for funding

Call topic	Acronym	Full Title	# Part-ner	Funding organisations
Integrated Computational Materials Engineering (ICME)	FMF	Flexible magnetics filaments:properties and applications	3	Nouvelle-Aquitaine (France); SAS (Slovakia); VIAA (Latvia)
Innovative surfaces, coatings and interfaces	BioElectroCathode	Utilization of CO2 through novel BioElectroCathode systems for production of biofuels (CH4 and ethanol)	4	RPF (Cyprus); NCBiR (Poland)
Innovative surfaces, coatings and interfaces	ENVALGRA	Development of a new generation of environmentally friendly microalgal oil-based functional fluids modified with graphene family nanomaterials (GFNs)	4	IDEPA (Spain); FNR (Luxembourg); TÜBITAK (Turkey)
Innovative surfaces, coatings and interfaces	ISIBHY	Increase of Strength of Interface Between liner and composite in HYdrogen tank	3	Calabria (Italy); Nouvelle-Aquitaine (France)
Innovative surfaces, coatings and interfaces	PLACOATAM	Functional surfaces on AM objects with a low cost atmospheric pressure micro PLAsma COAT instrument integrated on a 3D printing equipment	4	FNR (Luxembourg); Nouvelle-Aquitaine (France)
High performance composites	Boron-Basalt fibers	Development of boron-infused basalt-fiber reinforced concrete for nuclear and radioactive waste management applications	5	ETAG (Estonia); NCN (Poland)
High performance composites	DURACER	Durable ceramic composites with superhard particles for wear-resistant cutting tools	4	ETAG (Estonia); SAS (Slovakia); NCBiR (Poland)
High performance composites	NANO2COM	ADVANCED POLYMER COMPOSITES FILLED WITH NOVEL 2D NANOPARTICLES	3	RCL (Lithuania); SAS (Slovakia); VIAA (Latvia)
Multifunctional materials	Bio4Cryo	Development of Biobased Cryogenic Insulation Modified with Nanocrystalline Cellulose	4	VIAA (Latvia); NCBiR (Poland)

Multifunctional materials	DryProTex	Dry Processing of functional materials into semi-finished Textiles for next-generation energy storage	7	Business Finland (Finland); KIT (Germany)
Multifunctional materials	MarTEnergy	Sustainable and Affordable Half-Heusler based Thermoelectric Converters for Utilization of Waste Heat into Electrical Power in Maritime Applications	3	MOST (Israel); RPF (Cyprus)
New strategies for advanced material-based technologies in health applications	DD-scaff	Drug delivering 3D printed scaffold strategy brings human body implants to the next level of personalization	3	RCL (Lithuania); VIAA (Latvia)
New strategies for advanced material-based technologies in health applications	nanoPD	Development of a novel organs-on-a-chip platform for nanodrug delivery and functionality testing to treat Parkinson's disease	7	MOST (Israel); MOST (Taiwan); NKFIH/OTKA (Hungary); FNR (Luxembourg); SERI (Switzerland)
Materials for Additive Manufacturing	3DPrintInn	3D Printable Innovative Biobased Materials for Wood Mimics	3	FNR (Luxembourg); VIAA (Latvia)
Materials for Additive Manufacturing	4DbloodROT	4 Dimensional Single Piece Miniaturized Blood Rotor	8	FFG-TP (Austria); NCBiR (Poland);
Materials for Additive Manufacturing	ECOPRINT	New Composite Materials for Additive Manufacturing	7	FFG-TP (Austria); JÜLICH (Germany)
Materials for Additive Manufacturing	MatLaMeD	Development of New H-type Tool Steel Materials via Wire- and Powder-based Laser Metal Deposition for Toughness and Hardness Enhancement	5	VLAIO (Belgium); SPW (Belgium); KIT (Germany)
Materials for Additive Manufacturing	NADEA	Nano-scale duplex high entropy alloys produced by additive manufacturing	7	MOST (Israel); NCN (Poland); JÜLICH (Germany)
Materials for Additive Manufacturing	Reliable GF-3D	Enhancement of reliability of 3d printed fibre reinforced polymer parts via material modelling and insitu 3d X-Ray inspection technology	6	JÜLICH (Germany); M2i (Netherlands)

Materials for Additive Manufacturing	SYMPA	Stereolithography materials, production and plasma-postprocessing for durable automotive applications	7	FFG-TP (Austria); JÜLICH (Germany)

3DPrintInn

The overreaching objective of the present 3DPrintInn project is to utilize non-woody biomass such as crop residues, plant biomass side streams to develop novel renewable biobased 3D printable polymeric UV-curable inks that mimic wood properties. The developed biobased polymeric inks will have the potential to replace presently oil-based raw components and implement smart manufacturing through the use of additive manufacturing (AM) and thus efficiently contributing to the burgeoning a bio- and circular economy. This novel concept will be validated and tested (performance service life durability stability mechanical properties) for the prototypes of wood based industry and plastic product sector. Such ambitious objective requires the establishment of a consortium with key knowledge and competences covering different aspects of chemical engineering, nanofibres and nanoparticles, wood-based products, 3D printing and industrial manufacturing, which is established in the present project.

Bio4Cryo

The Bio4Cryo project aims to develop multi-layer polyurethane cryogenic insulation with a thermoreflective coating, using sustainable resources from agricultural & forest industry. The Bio4Cryo will focus on industrially feasible and up-scalable technologies while taking into account sustainability of developed products & technologies. Cryogenic insulation is only produced from petrochemicals. Biobased cryogenic insulation materials are innovation on global level. A big concern for Europe is dependence on fossil feedstock in chemical & energy production due to economic considerations but also due to broader perspective of sustainability. The Bio4Cryo project aims to focus Europe's common efforts towards a sustainable, high value biobased economy using European origin biobased feedstock and to improve Europe's industrial competitiveness, sustainability and strengthen the industrial leadership.

BioElectroCathode

BioElectroCathode project aims to bring innovation on biological electrosynthesis biocatalysts through: a) the manufacture of novel cathodes, b) the manufacture of a 3D biological electrosynthesis baffle reactor that can transform CO2 to CH4 and/or CO2 to ethanol. The project starts from a TRL between 2-3 and by the end of the project aims to reach TRL 5.

BioElectroCathode project will help in solving three main challenges of the contemporary energy systems: power storage, grid stability and CO2 emissions. Electricity can be supplied for the power of the cathode in the Microbial Electrosynthesis Baffle Reactor and it can convert CO2 into CH4 and/or CO2 into ethanol. The methane-rich biogas (biomethane) or ethanol can be stored, distributed and utilized as a fuel in vehicles compatible to natural gas. The proposed technology can be used in biogas plants (in Europe there are more than 12,400 biogas plants) or in industries that generate high amounts of CO2.

Boron-Basalt fibers

The aim of the project is to develop a novel composite material – fiber-reinforced concrete with basalt-boron fiber. It improves mechanical and enhances radiation-shielding properties, it could be used with various neutron sources, including nuclear and fusion reactors. This composite material increases substantially operation safety of radioactive sources and consequently better public acceptance of nuclear energy.

Expected result include modelled of shielding properties for gamma-ray and neutron radiation; developed methodology for production of basalt-boron fiber for industrial conditions; performance testing of the fiber in laboratory conditions; mechanical performance testing of the fiber-reinforced concrete; experimental validation of shielding properties for neutron radiation.

Development of this fiber-concrete is expected to have a considerable economic and environmental impact due to increased concrete durability and improved safety in operation of radioactive sources.

DD-scaff

Project DD-SCAFF includes: design, development, testing, biological evaluation and fabrication of novel skeletal implants with unique synergy of properties – high mechanical strength and bone regenerative effect combined with antibiotic delivery to reduce the risk of manifestation of secondary infections. The implant shape and antibiotic drug release profile from the implant will be tailored to meet the personalised therapeutic needs of the patient. The project aims to create an innovative biomaterial-based strategy providing prolonged antimicrobial protection at the site of implant application.

The personalized product will combine a titanium implant with porous scaffold parts that are interpenetrated with calcium phosphate bone cement and gentamicin loaded PLA microcapsules which will ensure pre-programmed local delivery of the antibiotic to surrounding tissues, thus minimizing systemic toxicity effects and possible interactions with other drugs used by the patient.

DryProTex

Aim of the project is to establish a new solvent-free Dryfilm technology for the production of freestanding, flexible, multi-functional, semi-finished textile films with broad applicability, e.g. as filter mats, catalyst layers etc.

The application area of the project addresses battery electrode manufacturing for two kinds of next-generation energy storage devices: Li-S and Na-battery cells and SoA MnO_2 cells for enhanced energy density at reduced costs.

Conventional coating processes with expensive drying steps will be replaced by our technology with huge economic and ecologic benefits. A European consortium has been set up along the value chain, covering material, process, equipment and battery cell development.

As a main outcome equipment will be designed and implemented in the process line at IWS for demonstrating the potential of this disruptive technology. Our aim is strengthening Europe’s future position in multifunctional materials, equipment design and battery cell production.

DURACER

The aim of the DURACER project is to utilize the remarkable beneficial properties of cubic boron nitride (cBN) to obtain a new generation of Spark Plasma Sintered (SPS) tool materials and to use these materials to create high-performance cutting tools. The modification of alumina-based matrix with cBN particles will improve hardness, fracture toughness and wear resistance of DURACER composites. Comprehensive tribological studies and industrial machining tests will demonstrate the performance of the material in the industrially relevant environment. The cutting tools made of DURACER composites could substitute a large portion of tools made of sintered carbides (because of better performance at elevated temperatures), ceramics (because of higher hardness and fracture toughness) and superhard materials (because of better wear resistance-to-cost ratio). Potential consumers of the project results are mainly manufacturers of tools and tools users.

4DbloodROT

Heart failure is an epidemic of the 21st century and occurs in 33% of the population above 55 years, with a 30-days-mortality of >11%. Heart transplantation is gold standard for end-stage heart insufficiency, but donor hearts cover only <0.5% of the demand. Alternatives are mechanical heart assist systems (e.g. ventricular assist devices, LVADs) during the drug-supported regeneration phase of the patient's heart.

However, LVADs struggle with device-induced thrombus formation due to inadequate blood flow dynamics of the blood pump rotor, leading to the definition of the 4DbloodROT project. Focus is the R&D on stereolithography-based additive manufacturing, novel hemocompatible materials and surface functionalization, all-together strongly extending the freedom for blood-flow-compatible design of rotors with novel exceptional biomimetic complexity (in 3D-shape & stiffness (=4D)). Final result is an in vitro optimized rotor design as basis for extended in vivo and clinical testing.

ECOPRINT

Efficiency and reliability of power-electronics strongly depends on temperature. Growing demands on miniaturization of electronic components while ensuring efficient cooling and keeping production costs low, raises a need for new materials and technologies. The ECOPRINT project addresses this need by developing new metal-polymer and hybrid metal-organic composites suitable for Additive Manufacturing (AM) processes. The main development steps are functionalization of metallic and ceramic filler particles by Atmospheric Pressure Plasma or wet chemical processes, compounding functionalized particles with high-strength polymer matrices, optimization of filaments, modification of 3D printing machines and investigation of new material concept for high temperature stability.

The ultimate goal of the project is to use the newly developed materials in an AM process to design low-cost, highly thermal-efficient heat-sinks or cooling pipes of complex shape or on-demand cooling solutions.

ENVALGRA

ENVALGRA aims at the developing of innovative, environmentally friendly microalgae oil-based functional fluids modified with graphene nanosheets (GNS). Different research studies have proven that critical tribological performance influencing properties are higher in chemically modified microalgae oil as compared to vegetable oil. The addition of graphene

will provide impressive lubrication and mechanical properties resulting in excellent wear resistance under a wide range of test conditions. Furthermore, in order to reduce environmental risks and accelerate its future commercialization, graphene will be synthesized from alternative sources such as pyrolyzed waste tire.

The main innovation of ENVALGRA project is that it will entail developing functional fluids with enhanced tribological properties compared to existing ones based on water or vegetable or mineral oil, more sustainable and environmentally friendly and with lower risk of occupational exposure.

FMF

Different technologies for synthesis of flexible magnetic filaments are developed. These include linking magnetic micro-particles by DNA, attaching magnetic nanoparticles to polyelectrolyte bundles, extraction of magnetosomes from magnetotactic bacteria and other. Flexible magnetic filaments are interesting for applications as self-propelling microdevices (for targeted transport), micro-mixers (for microfluidics), different sensors (micro rheology). Numerical algorithms for predicting their behavior in magnetic fields of different configurations will be developed, including algorithms based on curve dynamics, lattice Boltzmann method, Brownian dynamics. Obtained numerical results will be compared with experimental results of measurement of flows fields around magnetic filaments, their buckling instabilities. As a result new technology will be developed for DLS measurements giving access to characteristics of translation and rotational motion of string like magnetic micro-objects.

ISIBHY

The use of hydrogen as an alternative to fossil fuels is an increasingly popular solution to cope with global warming and meet the goals of reducing CO2 emissions. However, hydrogen tanks have limited performance due to the early detachment of the liner with the composite. The project aims at improving the durability of the wound tank and to delay the optimum use time. The rupture of the interface between the liner and the composite may lead to a situation in which the tank does not longer assure its functionality as a reservoir. The ISIBHY project aims to increase the liner-composite assembly performances by improving the adhesive formulation and performing specific thermomechanical tests to understand the mechanisms at stake in explosive decompression process. Through testing and simulations of interfacial failure, the results are ultimately expected to enable the design of the next generation materials able to sustain the effect of explosive decompression.

MarTEnergy

The main objective of the proposed research is to develop highly efficient half-Heusler (HH) based prototype thermoelectric (TE) converter consisting of non-volatile cost-effective elements for operating temperatures ranging up to 700oC (n-type ANiSn and p-type ACoSb (A=Ti, Zr, Hf)), covering most of the potential applications conditions, including maritime gasoline engines. Overall, the objectives of the MarTEnergy are: (a) Synthesis of cost-effective highly efficient HH based compositions (b) Development of highly durable, compatible and stable joining techniques between the TE semiconductors and the involved metallic joints (c) Integration of the entire components into practical devices (d) Finite element analysis on the prototype converter performance prediction in the maritime shipping

industry to improve competitiveness and strengthen the maritime sector leadership. TRL levels start from 2 (technology concept formulated) to 4 (technology validation in lab).

MatLaMeD

∫ (Materials Tech + Laser Tech + Production Tech)dt= Fatigue Life

MatLaMeD offers a unique opportunity to focus at a transnational level on those technologies that have a significant impact on the fatigue life of hot forging dies and, ultimately, on the economics of production technology. Life of dies is limited by thermo-mechanical fatigue which degrade the quality of die surfaces and finished parts. Hence, the innovative objectives of the project are defined to address the above issues: the development of new types of hot-work tool steel by wire- and powder-based laser metal deposition as well as the development of casting process to produce a laser cladding wire with specific chemical composition. The new hot-work tool steel materials will possess higher toughness and hardness and, ultimately, guarantee a positive impact on the fatigue life of dies. The project has a huge potential to encompass key European industries such as advanced materials, laser additive manufacturing and PLM.

NADEA

NADEA will develop a nano-scale duplex material starting from a Co-free high entropy alloy while taking advantage of a unique phase transformation pathway via spinodal decomposition of the primary BCC-phase and concomitant FCC-formation. The novel material shall out-pass duplex or super-duplex steels and provide a significant strength increase and good corrosion resistance for centrifugal pump impellers. AM-manufacturing of impellers is envisaged by Laser Metal Deposition (LMD) and Selective Laser Melting (SLM). They both offer extraordinary means to tailor the primary grain size throughout the component, thus improving the material's resistance to cleavage fracture. The entire process chain from powder production to demonstrator manufacturing and testing will be developed from TRL2 to TRL4 including alloy design, microstructure modelling, process development and the analysis of mechanical and corrosion properties.

NANO2COM

NANO2COM is aimed to development of advanced high-performance composites with outstanding mechanical and electrical properties by addition of novel MXene nanosheets and graphene into epoxy matrixes. The project will firstly go forward to the rational design and systematic exploration of hybrid MXene/graphene-based polymer nanocomposites for flexible electronics and advanced construction components. It will be achieved by establishing the research cooperation among the consortium members and the industrial advisory board for the development and assessment of the novel materials. The scientific results of NANO2COM include comprehensive assessment of mechanical and electrical properties of hybrid MXene/graphene-filled polymers, and the development and validation of two lab-scale demonstrators, advanced FRP filled by hybrid nanofiller, in potential application fields. Testing of the demonstrators will be realized in laboratories and in supporting industries in relevant environment.

nanoPD

The proposed project intends to establish the usage of on-chip-solutions, with integrated sensors, for in vitro disease modeling and to study the ability of the newly-designed

nanodrug delivery systems (NDDSs) to deliver therapeutic agents to midbrain-organoids using membrane-integrated microfluidic devices. A particular focus is aiming at developing an organs-on-a-chip device for Parkinson's disease (PD) that should address the effect of biological barriers for disease onset and treatment and elucidate the drug inhibiting mechanisms. The success of this project would not only provide insights on the mechanisms and principles on designing these NDDSs, but also drastically reduce the use of animal models for drugs and therapy testing. Moreover, it will highlight the development of a novel screening platform with patient specific induced pluripotent stem cells (iPSC) for advanced personalized medicine.

PLACOATAM

PLACOATAM will design, process an innovative atmospheric pressure plasma enhanced chemical vapor deposition solution (AP-PACVD) based on a micro plasma jet that can be integrated on 3D printing equipment and able to perform metallic and inorganic films. As the deposition processing will need to be done on complex surfaces and on thermal sensitive materials, a new type of High voltage nanopulse generator will have to be developed for giving to this AP-PACVD device, the possibility to generate "homogeneous plasma" (less filament discharge) in a very small volume and a relatively extended plasma plume with a limitation of the gas temperature. During the second part, PLACOATAM will propose for the first time, "3+2D printing" concept for a rapid manufacturing of finished functional products where two highly efficient material processes are associated: 3D printing technology and an atmospheric pressure plasma 2D surface deposition process.

Reliable GF-3D

The main objective of the project is to enhance the reliability of Fused Filament Fabrication FFF parts to enable their use as real, loadable parts, e.g. for use as spare parts for automobiles or machines, personal protection equipment or even for repair of thermoplastic structures etc. where highly flexible and customized manufacturing processes are strongly recommended. Therefore, also fibre reinforced (short fibre and continuous fibre) polymers, which provide better mechanical performance, are in the focus of the investigations. This shall be achieved via scientific approved qualification of 3D-printed objects made by the FFF technology on portal and also robot based printing systems. For a deep understanding of the correlation between material composition, process parameters and the mechanical performance of 3D printed parts and 3D X-Ray insitu inspection method shall be developed.

SYMPA

Project SYMPA aims at developing new raw materials and post-processing technologies for durable Stereolithography (SLA) products with a focus on automotive applications. By overcoming the weaknesses of current SLA materials such as low mechanical properties and UV stability, this AM technology enables the production of individualized products specifically designed for customer needs. The innovation objectives include the development of a new photosensitive polymer with increased thermal and mechanical properties, the fibre reinforcement of the polymer and surface modification technologies to further improve the environmental resistance of products. The German/Austrian project consortium is set up along the entire value chain of SLA technology including material developers, machine producers, research institutes and end users. All developed technologies will be

demonstrated on the basis of real automotive structures considering the requirements on industrial production processes.