Innovate UK

Results of Competition: Materials for Demanding Environments
Competition Code: 1510_FS_ADVM_ENVRM

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Siemens PLC Victrex Manufacturing Ltd	High Tg Polymer for Subsea Applications	£100,802	£50,326
Project description - provided by applicants			
Characterisation of developmental high Tg polymer for subsea oil & gas applications.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Gwent Electronic Materials Ltd NPL Management Ltd Microsemi Semiconductor Ltd	OrCA - Organic hybrids for Circuit Assemblies	£149,997	£90,491
Project description - provided by applicants			
There are an increasing number of electronics applications in aerospace, automotive, offshore, shale gas & powermanagement, which are required to operate at or above 200C. Organic reinforced substrates such as polyimidehave maximum operating temperatures of up to 140C, so such applications are forced to use expensive & heavyceramic technologies. Such assemblies are based on alumina substrates with printed inks fired at ~ 850C. TheOrCA project with investigate replacing the alumina with high temperature engineering thermoplastics such asPEEK and utilising silicone based ink systems curing at around 250C. Component interconnect will exploit theELCOSINT conductive adhesive system developed by the project partners in a recent Innovate funded project.Such an assembly system will benefit from reductions in substrate cost, and assembly weight. Energy costassociated with manufacture will be significantly reduced. In addition the organic substrate will be easier tomachine and form into complex shapes and offers the possibility of integrating through-hole components andthermal management solutions. The suitability of such a system to operate continuously at 250C will be explored.			

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Weir Minerals Europe Ltd The Manufacturing Technology Centre Ltd	Wear resistant materials for highly erosive environments (WEAR)	£149,802	£96,900
Project description - provided by applicants			
This project addresses the urgent need for new materials which offer radically improved performance forthe manufacture of critical components for slurry pumps. These pumps, used extensively in coal and mineralmining and processing, are subject to impact, wear and corrosion. Current materials, typically white cast iron,are only able to provide some of the properties required in this extremely demanding environment, thuslimiting the service life of parts and increasing the risk of premature failure. This high value equipment is ofteninstalled in remote locations overseas making replacement difficult and costly. Moreover, failure can halt majormining operations, leading to substantial financial penalties. In WEAR a novel material solution, will bedeveloped using an advanced powder metallurgy approach. In the project samples of material will besubjected to accelerated life testing and the most appropriate material will be used to produce ademonstration part which will be tested in the field.			

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Energenics Europe Ltd Brunel University	Advanced Substrate for Diesel Particulate Removal	£149,599	£118,135
Project description - provided by applicants			
Soot particles from diesel engines are now recognised as carcinogenic and are a major contributor to urban airpollution. Modern cars and trucks are fitted with Diesel Particulate Filter (DPF) systems which are composed ofporous honeycomb structures which trap soot particles and then oxidise them using the exhaust gases whenthere is sufficient heat. This project aims to prove the feasibility of a novel filtering device capable ofdynamically trapping and eliminating soot particles. The device uses a fibrous substrate sandwiched betweenhighly porous ceramic plates. Trapped particles are removed by exposure to high electric current densities. Theproject intends to develop advanced versions of a fibrous substrate where loadings of adsorbed nanoscaleoxidation catalyst facilitate soot removal at lower temperatures. Such advanced substrates will enable thedevelopment of attractive novel alternatives to conventional DPFs which can potentially make major in-roads inproviding effective, lightweight, cost-effective, robust and affordable emissions abatement technology fordeveloping countries with severe urban air quality problems like India.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Pollywood Ltd Bangor University	Innoavtive Wood Composite Poles	£149,974	£117,947
Project description - provided by applicants			
This project is designed to provide scientific underpinning to the development of a unique structural pole,which will have wide application when developed across the built environment. Pollywood Ltd have immediateinterest for the development of a replacement for the creosoted transmission pole from the Energy InnovationCentre, who co-ordinate research for the Distribution Network Operators (DNOs). There is legal/environmentalpressure from the EU to replace these poles and therefore a pressing need to find an effective alternative.Existing competitors to the wood pole have other issues, which make them sub-optimal. Transmission poleshave to have long lives in a wide range of conditions including extremes of heat and cold. Solving this problemwill create social and economic benefits including jobs in an area, which has lost many steel industry jobs aswell an export opportunity for the UK.			

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GPFOne Ltd NCC Operations Ltd	Functionally pigmented protective surfacing for advanced composites	£149,799	£117,875
Project description - provided by applicants			
Utilising proprietary technology and expertise initially developed for Formula 1 motor racing, GPF One isseeking to develop and commercialise a portfolio of novel carbon fibre composites with broad industryapplication.In the proposed project, GPF One will work collaboratively with the National Composites Centre to evaluate thetechnical feasibility of radically enhancing the performance of its advanced composite materials for applicationin a variety of demanding environments.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Alsitek Ltd Tremco Illbruck Ltd University College London (UCL) London South Bank University	FireStop	£149,716	£107,587

Project description - provided by applicants

The FireStop project will develop a novel firestopping material that can be used for sealing the gaps in firecompartments between cables/pipes and the compartment wall. The project will focus on achieving flexibilityof a foam based solution that is both 100% fireproof, and does not contain isocyanates. Unlike currenttechnologies that prone to cracking under thermal expansion or sudden shock movements, FireStop will havesufficient flexibility to allow for these movements. Additionally benefits of the FireStop solution are that it doesnot require manual mixing of components, making it faster to apply, cheaper for the end-user and removingthe factor of human error, it does not contain any type of toxic materials in the production process or releasethem when exposed to fire, it has a low a carbon footprint, the self expanding foam makes it easy to apply evento difficult to reach areas, the lower density of FireStop makes it lighter, which has particular benefits for high-rise constructions and reduces the overall amount of foam required. Lastly, besides filling gaps of 25-100 mm itcan also seal linear gaps between building elements of up to 100mm wide.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
Victrex Manufacturing Ltd University of Southampton	Tribological characterisation of new PAEK polymer developments	£97,571	£48,785
Project description - provided by applicants			
High performance injection mouldable polyaryletherketone family (PAEK) polymers, and their engineeredcompounds, are materials that facilitate and enable automotive manufacturers to achieve safety,environmental and cost goals now and in the future. For automotive powertrain designers and manufacturers,addressing frictional performance needs of new technology adopted onto the modern passenger car is a keyperformance challenge. As automotive powertrain manufacturers continue to innovate to meet the legislationand cost goals, the pressure, velocity and temperature can affect the frictional performance of componentsand as such will reduce the lifetime reliability. The project objective is to fully chararcterise the tribologicalperfomance of current and new PAEK polymers. Assessing the tribological performance of development PAEKpolymers would provide a starting point to determine the performance potential at an early stage foraddressing the needs, and support the delivery of a solution to enable continued downsizing, weight saving andincreased reliability to Automotive powertrain manufacturers.			

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ITM Power (Trading) Ltd Escubed Ltd	Development of new low cost coating materials for PEM electrolysers	£149,602	£95,344
Project description - provided by applicants			
The demand for electrolysis is set to rapidly increase with the roll out of Hydrogen Refuelling Stations (HRS) andPower-to-Gas systems. However, to guarantee widespread uptake of the technology the cost of the systemsneeds to come down. To this aim there has been significant success in reducing catalyst costs for electrolysers.Catalyst loadings have now been reduced to the point that there is now more platinum per square centimetrein the titanium coating than in the electrolyser catalysts.This project seeks to employee novel materials to coat titanium components which are resistant to the harsh,high pressure, highly oxidative and corrosive environment within an electrolyser. The ultimate project aim is tosignificantly reduce the cost of electrolyser titanium coatings without compromising durability ofperformance.			

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Asymptote Ltd University College London (UCL)	Shear-thickening fluids for cryopreservation	£149,790	£118,295
Project description - provided by applicants			
In regenerative and transplantation medicine medicine a bottleneck limiting progress is that tissue engineeredconstructs cannot be manufactured on demand. Cryopreservation aims to overcome this problem, howeverwhilst success has been achieved with cell suspensions, successful scale up of construct size has remainedelusive. No methods exist that can protect complex biomasses from the severe stress they encounter duringcooling and warming from liquid nitrogen (-196°C). We propose a new method, where non-Newtonian, shear-thickening fluids can be used to improve operational performance of cryopreservation. Shear thickening fluidsare materials whose viscosity increases with shear stress, for example vibration. With the correct level ofvibration, the material can change from a liquid to a solid instantly. We propose this as an effective material forextremely low temperature biological preservation. At the storage temperature, shear stress would be stoppedas the material would remain solid (vitrified) due to the low temperatures. The shear-thickening materialsmake the process completely reversible.			

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Composites Evolution Ltd TRB Lightweight Structures Ltd	Fire-retardant bio-based composite panel for train interiors (FR-TRAIN)	£142,437	£94,134
Project description - provided by applicants			
The FR-TRAIN project will develop a lightweight, fire-retardant, environmentally friendly composite material forrail interiors. The shift towards high speed, nimble, electric & hybrid trains is driving the adoption of lightweightmaterials, including fibre-reinforced composites. Currently, most composite rail interior panels & mouldingsuse phenolic resin due to the stringent fire requirements. However, phenolics emit large amounts of CO duringcombustion and their use is expected to be restricted as they contain toxic and carcinogenic compounds.FR-TRAIN will develop a revolutionary composite material based on polyfurfuryl alcohol (PFA), a resin derivedfrom biomass waste, which has low flammability and smoke emission, is non-toxic, renewable and offersbenefits including faster curing and improved surface finish. The PFA resin will be used with a fibrereinforcement and a lightweight core to produce a composite panel system, which will be tested against thestringent rail interior standards. Initial applications are likely to be walls, floors, bulkheads and lavatorymodules, as part of the £180m/yr in European market for these materials.			

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TRAC Engineering Ltd Offshore Renewable Energy Catapult Scott Bader Company Ltd	AdvantEDGE2	£148,572	£86,127
Project description - provided by applicants			
This project relates to the development of a novel protective repair solution for wind turbine blade leadingedges. The project will develop a unique thermoplastic adhesively bonded shield material, which whencombined with a remote on blade machining capability, and pre-formed to the blade CAD profile, will allowsignificantly faster leading edge repair capability.Three thermoplastic solutions will be tested within the project, all developments of a thermoplastic solutionwhich in rain erosion tests showed outstanding performance, predicted to be capable of 20+ years of in-servicelifetime. One thermoplastic and adhesive solution will be developed to TRL5, ready for in-service trials. Thesolution will be compared for its realistic repair mechanical properties against a composite filler repair andproduction material.			

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TISICS Ltd University of Sheffield	Metal composite Actuators For exposed high load, damage tolerant landing gear	£150,000	£112,897
Project description - provided by applicants			
This project aims to develop light weight silicon carbide fibre reinforced hydraulic actuators for demanding highperformance applications in harsh operating environments. The project will focus on aircraft landing gear asthis has a both a demanding operating environment and loading rudiments and a requirement for lightersystems and components to reduce CO2 emissions.The output is targeting a 40% lighter hydraulic piston rod and actuator cylinder that is capable of meeting thehigh pressures and loads required for landing gear as well as the resistance to Skydrol and typical landing gearoperating environment such as grit abrasion, runway debris and extremes of temperature.The use of fibre-reinforced titanium will be a potential solution to the need to find alternatives to chrome andcadmium plating systems under REACH.TISICS is aiming to demonstrate the potential for the technology with test data produced by the highlyexperienced and well-equipped facilities and staff at the AMRC in Sheffield.			

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Far-UK Ltd University of Warwick	Lightweight and Low-Cost Composite Beam for Rolling Stock Applications	£150,003	£118,502
Project description - provided by applicants			
This project will establish the potential application of a cost-effective composite beam to address the need forlightweight structures in the rail industry. The composite beam moves away from traditional high-wastecomposite solutions and is an alternative to metal components currently used in the rail sector. It will offer anew way of designing car bodies and bogies and flexibility in the dimensions of the beam along its length, widthand height, supporting end-users' needs. To demonstrate the possibility of using such beams for rolling stock, itis essential to determine the performance of the composite structure in extreme conditions. The LoCoBeaStconsortium is led by Far-UK Ltd, who has developed a patented composite beam technology called Axontex,and has WMG as an academic partner who will share its expertise in high-load and environmental testing. Themain project output will be a small-scale demonstrator verifying that a low-waste and affordable compositebeam can sustain extreme conditions and therefore be a new disruptive solution for the rail industry.			

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NetComposites Ltd Sheffield Hallam University	Fire-retardant nanocomposites for aircraft interior applications (PF-Clay)	£145,611	£114,939
Project description - provided by applicants			
Currently, the most commonly used materials for aircraft interiors are glass or carbon fibre or reinforcedphenolic composites. These phenolic-based materials are used because of their good fire performance.However, phenolics are less good in other respects, notably the surface finish quality of their moulded partsand the fact that they contain some potentially harmful ingredients.NetComposites has developed a substitute composite material that overcomes both the surface finish andhealth and safety limitations of phenolics. However, whilst this new material matches or outperforms phenolicsin most respects, its fire performance is still somewhat marginal.This project will explore how novel nanoclays might be used to improve the fire performance ofNetComposites' new material, thereby allowing the aerospace industry to appropriate its wider benefits.			

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Ionix Advanced Technologies Ltd University of Leeds	Piezoelectric ceramic-glass composites for high temperature ultrasound applications	£134,262	£99,909
Project description - provided by applicants			
Piezoelectric materials are used to produce and sense ultrasound in instrumentation used to monitor structuralintegrity, monitor flows and measure distance variations in a rnage of industrial environments. Ionix AdvancedTechnologies specializes in piezoelectric materials and ultrasound devices for the high temperature applicationsin this field. The project will develop a new form of piezoelectric material, a composite comprising apiezoelectric ceramic and a porous glass which will exhibit advantageous properties for ultrasound use at hightemperatures. The resulting instruments will have high sensitivity, improved spatial resolution and muchimproved signal to noise ratio, enabling new applications for these systems in safety critical applications inpower generation, the oil & gas industry, plus the automotive and aerospace sectors.			

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