Innovate UK

Results of Competition: Materials and Manufacturing Round 3 - 25-36 Months

Competition Code: 1705_MM_R3_36M

Total available funding is £15m

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
SUSTAINABLE DRAINAGE SYSTEMS LIMITED	Automated ultrasonic welding of lightweight honeycomb structures	£507,755	£304,653
KERONITE INTERNATIONAL LIMITED		£130,344	£91,241
SIMS ENGINEERING SYSTEMS LIMITED		£1,035,329	£724,730
TWI LIMITED		£321,178	£321,178

Project description - provided by applicants
Global warming is expected to increase the intensity and frequency of extreme rainfall events. Coupled with urbanisation, these factors are increasing the size and frequency of floods that regions are exposed to. Approximately 2million people in the UK, and many more across the globe, are at risk from pluvial, or rain related, flooding (JRF-Foundation-UK). Pluvial flooding occurs when an extremely heavy downpour of rain saturates the urban drainage system and the excess water cannot be absorbed. Sustainable Drainage Systems (SuDS) are a sustainable way to deal with pluvial flood events. SuDS limit the discharge of stormwater from an area, both in flow rate and in volume, enhance the water quality of any discharge; and incorporate devices which provide habitat and enhance the environment. Lightweight-honeycombed (LHC) geo-spacer structures offer an ideal SuDS solution. The project will develop an advanced ultrasonic welding production rig for the sustainable high-volume manufacture of SuDS made from recycled PVC. The focus of the innovation will relate to the development of existing ultrasonic techniques and their application in the robust joining of "corrugated" vacuum-formed sheets made from recycled PVC materials.

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CASTALUM LIMITED	3D-printed conformal cooling channels for extended tooling life	£615,648	£369,389
Coventry University		£235,574	£235,574
RENISHAW P L C		£185,094	£92,547

Project description - provided by applicants
CastAlum is an internationally acclaimed aluminium die caster, located in Mid Wales. The company supplies parts to the UK, Germany, Poland, Canada and Mexico and recently won its first order from a truck manufacturer in the Far East. Today, one in ten vehicles produced in Europe has a steering gear housing manufactured by CastAlum in Welshpool. High-pressure aluminium die-casting (HPADC) is an established technology superior to other casting techniques for serial manufacture of lightweight thin-wall components, physical properties in high-demand by the automotive components sector. However, inadequate cooling of dies and cores can lead to 'Hot Cracking', connected porosity, and high levels of rejects. To tackle the industry wide challenge of hot cracking, connected porosity and high reject rate, CastAlum are exploiting digital design processes and state of the art manufacturing techniques to optimise die cooling/heat transfer and extend tooling life from 100,000 to 200,000 shots. The resultant technology will also reduce reject rate and enable manufacture of higher quality, lighter products for the automotive sector. CastAlum are collaborating with Renishaw PLC, one of the world's leading engineering and scientific technology companies, and The School of Mechanical, Aerospace and Automotive Engineering at Coventry University. Our consortium brings together leading experts in additive manufacture, material processing, thermodynamic flow modelling and CAD/CAM processes. Successful project delivery will cement our reputation as leading innovators within the industry and is the first step in an ambitious growth strategy to nearly double our market share.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
ETHER NDE LIMITED	Smart Residual Stresses Monitoring for Metal Additive Manufacturing – EM-ReSt	£400,535	£280,375
Brunel University London		£250,010	£250,010
HYBRID MANUFACTURING TECHNOLOGIES LIMITED		£99,170	£69,419
INNVOTEK LTD		£535,689	£374,982
SONEMAT LIMITED		£80,150	£56,105
TWI LIMITED		£189,266	£189,266

Project description - provided by applicants

Metal Additive Manufacturing (AM) is an emerging technology for rapid prototype manufacturing, benefitting aerospace and medical devices, as the immediate manufacturing of high-value, complex structured components is usually necessary in these industries. Hence, the structural integrity of printed structures is extremely important and should meet the specifications and high standards of the above industries. In several metal AM techniques, e.g. selective laser melting (SLM), electron beam additive manufacturing (EBAM) and wire arc additive manufacturing (WAAM), residual stresses and micro-cracks that occur during the manufacturing procedure can result in irreversible damage and structural failure of the object after its manufacturing. Repetitive faults which occur during manufacturing due to incorrect estimation of appropriate operating conditions of the printer should be eliminated, as any waste is undesirable and costly for a company.

The nature of some AM methods means that not all Non-Destructive Testing (NDT) techniques are effective in detecting residual stresses. Thermography, X-ray computed tomography (CT scan), or digital radiography are limited by the resolution of images (thermography), they are bulky and costly (up to Â£100k), are not suited to residual stress detection. Our solution, EM-ReSt, functions as an add-on to existing AM processes, comprising two sets of NDT techniques: Electromagnetic Acoustic Transducers (EMAT) and Eddy Current Testing. A crucial (and novel) extension of the proposed system is the incorporation of big data collection from the sensors and analysis through machine learning (ML) for estimating the likelihood of the AM techniques to introduce anomalies into the printed structures before the beginning of the manufacturing. A digital system that will estimate the potential and deficiencies of any AM technique for given structures will be developed and utilised for the establishment of a preliminary set of AM standards. Hence, more robust and reliable components will be printed and used.

EM-ReSt is fast (msecs/measurement and overall scanning time does not exceed a minute), reliable (90% PoD), non-destructive online monitoring of AM techniques, can achieve 15% reduction of faulty outputs with the use of 4 times more cost-effective monitoring system, has low profile sensing hardware with potential for EMAT and EC miniaturization. Our initial target markets are the global aerospace and automotive component manufacturing market. This project represents a clear technological innovation for the UK AM industry, and major growth opportunity for the SME supply chain consortium, which is forecast to generate revenues of Â£72.5M and 362 new jobs 5 years post-commercialisation.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
FIBERIGHT LIMITED	Developing a process to manufacture lactic acid from waste-derived sugars	£607,117	£424,982
Aberystwyth University		£319,041	£319,041
BIOTECH CONSULTANTS LTD		£136,700	£95,690
UNILEVER U.K. CENTRAL RESOURCES LIMITED		£42,362	

Project description - provided by applicants

The project aims to develop a process for manufacturing high grade lactic acid, which is a chemical used in many industrial sectors. Currently lactic acid is very costly to produce, primarily due to the cost of the food grade sugar and energy used, resulting in low sales margins. There is an opportunity to replace this source of sugar with a waste-derived sugar, with a range of commercial, environmental and social benefits. Fiberight has developed a process to recover value-added products from the municipal waste stream (landfill bound), including sugars derived from the paper component. The project will undertake research to identify the most sustainable and techno-economically advantageous process for the manufacture of lactic acid from waste-derived sugars, which can in turn be used to make polylactic acid; this can be used in the manufacture of bio-plastic products. Fiberight will work with academic and industrial partners Aberystwyth University, University of Bath, Biotech Consultants Limited and Unilever to undertake this research. The core team have worked together previously within a successful Innovate UK project where initial investigations demonstrated the ability to use Fiberight's sugars to produce a high yield of lactic acid.

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BENTLEY MOTORS LIMITED	FAST STEP 3 - Swarf Titanium to Engine Parts in 3 Steps	£636,492	£318,246
FORCE TECHNOLOGY LIMITED		£227,136	£158,995
NORTHERN AUTOMOTIVE ALLIANCE LTD		£150,402	£105,281
TRANSITION INTERNATIONAL LIMITED		£139,330	£97,531
University of Sheffield		£507,552	£507,552
VICTORIA DROP FORGINGS CO.,LIMITED		£127,387	£89,171

Project description - provided by applicants
The project utilises high value alloyed titanium (Ti) swarf as a feedstock to sinter-forge via the new, novel technology FASTforge process into near net shapes for use in high strength and good fatigue life applications typically required within an automotive engine. 4 engine components of increasing complexity from both a manufacturing and performance perspective will be manufactured and functional bench tested. To achieve this, a new UK supply chain will be developed, with diversification for companies within traditional metal manufacturing and "know how" transfer from University of Sheffield, combined with multiple areas for IP generation. The FAST process has existed for many years, but when combined with forging it can release its untapped potential. The process will produce Ti at 20% of the cost of current Ti billet and with minimal waste compared to the 70% waste generated within the aerospace industry. Success will mean: a) lightweight & lower CO2 & PM emissions for automotive engines. Initially within low volume, but with increasing confidence with the product & developed manufacturing processes it can then move into higher volume applications b) growth opportunities for the supply chain, initially within the low volume vehicle industry but with the potential to move into the higher volume market and also the wider advanced manufacturing sectors of off-shore, rail, aerospace, non-auto engines, defense & low cost desalination. Exploitation in these other sectors is supported by the 4 components selected c) the metal forming industry can stay abreast of new technology in alternative metals and use world-leading materials research to halt the decline of an industry within the UK.

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