Metallurgy Europe – EUREKA Cluster Programme

Official Call Text

Met-Euro-Call-01-2015

Background:

Metallurgy Europe is a seven-year EUREKA Cluster Programme (Σ!9169) started in 2014, with the ambition of developing and industrialising the next-generation of metallic materials and metallurgical manufacturing routes for the 21st century. The following 14 calls have been approved by the *Metallurgy Europe* Industrial Board for official release on 27th May 2015. Ambitious, large-scale, high-impact, market-driven cluster projects are being solicited in a broad range of metallurgical and manufacturing fields, in accordance with the *Metallurgy Europe* Technology Roadmap – 2014-2021.

Interested proposers are kindly asked to use the Project Outline Proposal (POP) template to submit their initial proposal ideas, in response to the 14 calls below. The evaluation criteria can be found in the POP document. After independent peer evaluation, the selected outline proposals will then be invited to submit a full project proposal in Autumn 2015. Projects passing the second stage of peer evaluation will be given the formal *Metallurgy Europe* Cluster Quality Label (MΣ) and handed over to the public authorities for their co-funding consideration. Upon contract signature, the front-runner projects are expected to start in Q2-2016.

Timetable:

1st stage call opening:	27th May 2015
Submission deadline for Project Outline Proposals:	31st July 2015
Peer evaluation of Project Outline Proposals:	September/October 2015
Information and feedback to proposers:	Early October 2015
2nd stage call opening:	October 2015 (tbc)
Submission deadline for Full Project Proposals:	January 2016 (tbc)
Peer evaluation of Full Project Proposals:	February 2016 (tbc)
Metallurgy Europe Cluster Quality Label Σ:	February 2016 (tbc)
Projects handed over to Public Authorities:	March 2016 (tbc)
Anticipated project kick-off:	Q2-2016

Proposal Submission:

Stage-1 Project Outline Proposals (POPs) shall be sent in two hard copies, using a trackable courier service, to the Cluster Office address below. N.B. Electronic submission is not permitted.

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Proposers will receive an Acknowledgement of Receipt (AoR) from the Cluster Office shortly after delivery.

Call Texts

Met-Euro-Call-01-2015-01

Multi-Material Solutions for Ultra-Lightweight Vehicles

Society's demands on surface and air transport pose an ever-increasing burden on energy and material resources. Along with the development of more efficient and alternative drive-trains, vehicle weight saving has thus become a major means to reduce our ecological footprint. Meanwhile, light metals such as aluminium and magnesium alloys have been introduced for a variety of vehicle components.

However, the potential of minimising overall vehicle weight by the optimised use of Al and Mg, as well as in multi-material structures, remains under-explored. Success of the European automotive and aerospace supply chain will, in the long run, critically depend on mastering these technologies to effectively and efficiently realise advanced multi-material solutions.

The project, being solicited in this call, shall address the current barriers impeding a structured and extensive exploitation of multi-material solutions for ultra-lightweight vehicles. In addition to achieving weight-saving over conventional designs, the project should also target a substantial reduction in development time for the design, manufacturing and engineering of such aluminium and magnesium structures. The integration of material, process and performance modelling approaches is also deemed important. New and enabling process technologies, like casting of metre-sized components, warm forming and joining of dissimilar materials, should all be considered. Technology demonstration shall include challenging structural applications from the drive-train, interior, body and chassis domains.

In summary, the selected *Metallurgy Europe* project here is expected to develop and industrialise the necessary process technologies to unlock multi-material structures in aluminium and magnesium for vehicle applications. This will give a major boost to the European transportation sector, as well as obvious environmental benefits and CO_2 reduction.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-02

Multi-Component Alloys for Extreme Industrial Applications

Many industrial applications are subjected to extreme operating conditions. This could be due to very high temperatures, high pressures, highly oxidising environments, corrosive and acidic attack, sour gases and steam, severe wear and abrasion, neutron irradiation, vacuum and deep-space, or even a combination of these. Therefore, very special materials are required, in order to produce components that can survive these kinds of harsh working conditions.

A range of alloys have been successfully developed over the past 50 years, such as nickel-based superalloys, ODS steels, PGM alloys, cobalt-chromium and tungsten alloys. However, these materials are being constantly challenged by designers and engineers, in pursuit of higher performance, reliability and product longevity. One way to improve these materials is to explore the vast opportunities of multi-component alloying, where 5-10 elements are mixed and solidified, for example in high entropy alloys, intermetallics and eutectics.

The project, being solicited in this call, shall address this uncharted multi-component space, thus helping industrial partners to find improved metallic materials for a range of extreme applications. The project should explore multi-component alloy systems best suited to the industry needs. There should also be a strong emphasis on gathering property data such as creep, fatigue, fracture toughness, wear resistance, hardness, oxidation resistance etc. Making the causal links between processing, multi-phase microstructure and properties shall be an important feature of this project. Scaling up the selected alloys from 0.1 kg to >100 kg production is anticipated in the project, in order to permit manufacturing and testing of industrial components for e.g. turbomachinery, pumps, nuclear reactors, hard tooling, dies and heat exchangers.

In summary, the selected *Metallurgy Europe* project here is expected to explore and develop new multi-component alloys that offer significant improvements over the conventional materials of today. Scale-up, industrialisation and component demonstration in a range of sectors is called for, to ensure the project has a lasting techno-economic impact for European society.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-03

Structural Steels for Non-Ambient Conditions

Advanced steel grades are used throughout the industrialised world for structural applications. While there are many alloy choices for steels at ambient room-temperature (as in the automotive and construction industry), there is a strong industrial need to develop better steels for structural applications involving *non-ambient* conditions. These needs include both very cold applications such as in cryogenic tanks, as well as in very high temperature applications like in power-generation plants and turbomachinery.

The project, being solicited in this call, shall focus on developing new cost-efficient alloying concepts for both cryogenic and high-temperature applications. Thermodynamic, atomistic and phase transformation modelling should be used to understand and develop new strategies for steel alloying, including control of tramp elements. New grades shall be proposed that can be manufactured at the laboratory scale, ideally in collaboration with the combinatorial alloy development project in *Metallurgy Europe* (see Met-Euro-Call-01-2015-09).

Once initially screened, the new alloys will need to be tested so that a comprehensive database of properties can be attained. Mechanical properties such as static tensile, fatigue and fracture toughness should be assessed, as well as creep and oxidation resistance for the high-temperature applications at 600-700°C. Optimal alloy conditions should be defined, also as a function of heat treatment and weldability. New discoveries in this field should be rapidly scaled-up for further demonstrator testing in industry.

In summary, the selected *Metallurgy Europe* project here is expected to design, develop and deploy new steel grades for challenging non-ambient conditions (both hot and cold). Usage of these kinds of special steels would have a large economic impact on several industries in Europe. Improved cryogenic alloys would allow further market growth in the field of liquified natural gas (LNG) storage, shipping, food and biomedical sectors; while improved high-temperature steels would make power plants more efficient by several %, resulting in even larger decreases in fuel cost and CO_2 emissions.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-04

Low Temperature Superconductors and Improved Wire Manufacturing

Superconductivity is of major interest for a wide range of industrial applications, now and in the future. While the search goes on for higher T_c materials, like cuprates, selenides and MgB_2, many of these new materials are too brittle to process easily into long electrical wiring. The vast majority of sales of superconductors today (95%) are in fact low-T_c niobium-based alloys, notably Nb47Ti and Nb_3Sn.

These metallic alloys constitute the key component of Magnetic Resonance Imaging (MRI) systems which are used in hospitals around the world, for imaging the heart, performing brain scans or detecting cancerous tumours. They are therefore an enabling materials technology in our modern healthcare system, with over 25,000 clinical MRI scanners in operation globally. In addition, these superconducting alloys also play an important role in fusion energy (e.g. ITER) and particle physics accelerators (e.g. CERN/LHC), where high-intensity magnetic confinement systems are required.

The project, being solicited in this call, shall address the research and development of new melt processing and powder processing methods for Nb47Ti and Nb_3Sn specifically. This will open up new capabilities for manufacturing high-quality ingots and feedstock powders for subsequent wire drawing, with improved properties and higher operational efficiencies.

In summary, the selected *Metallurgy Europe* project here is expected to adapt and develop new processing routes for making low-temperature superconductors, in order to improve their performance and lower fabrication costs, for the benefit of hospital healthcare, clean energy and experimental physics. The successful industrial development of these fabrication routes is strategically important for Europe and would lead to a more competitive and independent European superconductor market.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-05

Thermoelectric Generators for Harvesting Industrial Heat

Waste heat from vehicles, homes, power plants and industrial factories is one of the hidden scourges of modern society. At least 50% of the energy we use is sadly emitted to the atmosphere as waste heat. Harvesting this thermal energy and converting it directly into electricity would save enormous amounts of fossil fuels, help lower global CO_2 emissions and it would be a tremendous boost to the economy. One of the ways that waste heat can be scavenged is via the thermoelectric (TE) Seebeck effect: the simple and direct conversion between heat and electrical power without any moving parts or fluids.

The project, being solicited in this call, shall address the large quantities of waste heat from factories, power stations and vehicles and the expected outcome of the project shall be the demonstration and take-up of thermoelectric generators (TEGs) in industrial environments.

The project should carefully assess the existing set of thermoelectric materials (e.g. skutterudites, silicides, Heuslers, oxides etc) in terms of material availability, sustainability and scale-up potential, since TEGs are likely to become a mass-market product in the coming years. In parallel, new TE materials should also be predicted, screened and tested for future applications. New TE alloys could be screened, in collaboration with the combinatorial alloy development project in *Metallurgy Europe* (see Met-Euro-Call-01-2015-09).

Delivering new, affordable, robust thermoelectric devices for real-world industrial applications shall be the major priority of this project. Last but not least, it will be critical to perform long-duration testing of TE materials and generators in practical applications, in order to understand failure mechanisms, ageing, material reactions and overall reliability and longevity issues.

In summary, the selected *Metallurgy Europe* project here shall: (i) develop and understand the TE materials themselves, (ii) design, produce and test TEGs in an industrial waste heat environment, and (iii) perform long-term reliability testing. All this will give European industry a world-leading position in the field of heat recovery technology.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-06

Miniaturised Biomedical Devices Made From Metallic Alloys and Composites

In an ageing society, implantable biomedical devices are becoming increasingly common for a whole range of special healthcare products, such as pacemakers, orthopaedics, cochlear implants and health-monitoring sensors. To improve these products further, industry is in urgent need of new technologies, including better materials. This would then help miniaturise implants, as well as drastically improve their lifetime, their robustness and their bio-compatibility in the human body.

The project, being solicited in this call, is expected to focus on developing and trialling new, improved metallic alloys, graded laminates and composites for a number of medical implant devices. This will entail a combination of materials simulation and experimental testing. New metallic compositions shall be initially screened by database analysis, while experimental synthesis and rapid testing of metallic alloys could also be performed in collaboration with the combinatorial alloy development project in *Metallurgy Europe* (see Met-Euro-Call-01-2015-09).

New manufacturing routes such as 3D-printing and multi-layered structuring will be used to create more intelligent sensors and implants. Metallic and composite demonstrator components will also need to be tested for relevant mechanical properties, such as stress, stiffness and tribology. Last but not least, the project shall explore interfacial surface treatment, topological features and lattices for improved cell compatibility and growth, all coupled with cellular and molecular modelling.

In summary, the selected *Metallurgy Europe* project here is expected to develop and test the next-generation of metallic materials for biomedical implants, with the aim of bringing novel demonstrator devices to the market faster than ever before. In terms of impact, this would (i) deliver European leadership in the bio-implant industry, (ii) reduce the effort on clinical trials, and (iii) bring improved quality of life to an ageing population in Europe.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-07

Metal-based Embedded Sensors for Metallurgical & Infrastructure Applications

Embedded metal-based smart sensors are needed in a multitude of applications ranging from the macro- to the micro-scale. On the one hand, these sensors allow for improved control and efficiency of heavy production equipment, such as metal forging, rolling and wrought processing; while on the other hand, they can monitor local interfaces, e.g. between metal and semiconductor device in power electronic systems. In all cases, detailed measuring, understanding and controlling of parameters like heat and pressure are of paramount importance to the quality, reliability and safety of these metallurgical and electrical products. Completely new metrology systems need to be developed that can provide accurate, detailed, real-time data from within the functional components, while also being able to withstand the harsh service conditions for many years.

The project, being solicited in this call, shall develop robust, embedded sensors and networks of sensors. These sensors should provide useful static and dynamic mechanical, thermal and other physical parameters during real-time monitoring and control of power-electronics and metal production systems. The project should address in-situ measurement in a wide range of length scales, for example from thin-film interfaces (e.g. new metal-matrix composites) to large production tools. Driven by industrial requirements, the metal-based sensors should be fabricated, tested and then demonstrated in an embedded manner. The selected fabrication route for making sensors will need to be high-volume in order to ensure maximum take-up by industry partners.

Design, miniaturisation, integrated functionality and prototyping of the metal-based sensors should also be important features of this project. Once embedded in an application, the smart sensors will need to relay metrology data via wireless communication to a central computer. This should be also be trialled in a smart sensor network. The data should then be analysed in real-time and provide a closed-loop control for the production processes. Benefits in terms of better process efficiency, lower failure and scrap rates and long-term maintenance capability are expected.

In summary, the selected *Metallurgy Europe* project here shall develop and demonstrate new sensors and networks embedded inside metal components during processing, in order to provide a new health-monitoring capability. The industrial impact of such a project will be very high, since it will reinforce European leadership in the sector of embedded smart sensors and wireless communication. In addition, the selected project would significantly improve manufacturing efficiency for a broad variety of modern transport, energy and healthcare products.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-08

Additive Manufacturing of Large Metallic Structures

To date, additive manufacturing (AM) of metallic materials has been largely focused on small-sized components in the centimetre range with high shape complexity. However, there is also a strong industrial demand for producing large, single-piece, alloy components in the 1-5 metre range. The industry sectors typically requiring large metallic structures include aeronautics, space, defence, maritime, road transport, construction, as well as turbomachinery and power generation systems.

The project, being solicited in this call, shall focus on AM techniques, such as wire-fed plasma-arc, blown-powder and hybrid routes, that are capable of manufacturing and machining good-quality large parts with near-net-shape fidelity. Large demonstrator components with real-world applications are expected to be part of this project.

A strong focus shall be placed on industrialisation of the AM technologies in factories, as well as structuring and maturing the required supply chain for feedstock wires, powders, baseplates, AM equipment, CAD/tool-path software, process chambers, machining cells and NDT inspection equipment. Alloy chemistries better suited to AM processing, as well as multi-material parts, should also be explored as part of the project. All of the above will need to be supported by advanced AM process modelling, thermo-mechanical simulation and data informatics. Furthermore, a strong connection with the X-ray/neutron project (Met-Euro-Call-01-2015-12) in *Metallurgy Europe* is expected, as a way of measuring and understanding residual stresses and alloy freezing in large AM components.

In summary, the selected *Metallurgy Europe* project here is expected to (i) deliver large AM metallic demonstrators up to 5 metres in size, (ii) industrialise and accommodate large-scale AM equipment in European factories, and (iii) demonstrate excellent NDT inspection, quality assurance and standardisation of the processes and materials. This will give Europe a world-leading position for large-scale AM structures and their industrial certification.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-09

Combinatorial Alloy Development and Infrastructure

European industry needs to accelerate the discovery of new materials and get them to the market quicker than ever before. One way of achieving this is to use high-throughput (HT), combinatorial synthesis and experimental screening techniques, coupled with targeted numerical modelling of alloys and advanced materials.

The project, being solicited in this call, shall develop and establish a number of integrated combinatorial facilities across Europe, in order to rapidly produce and test large arrays of bulk and thin-film alloy samples. The targeted applications for alloys shall be largely determined by industrial requirements, as well as other *Metallurgy Europe* projects. The alloy classes to be synthesised shall typically include: solid solutions, high-entropy alloys, intermetallics, semiconductors, bulk metallic glasses, composites and other multi-component systems.

After initial HT screening, the alloy samples shall pass through a European network of analytical laboratories, dedicated to fully characterising the samples' crystallographic, chemical, physical and mechanical behaviour. Data emanating from this project will need to be stored in a well-maintained Virtual Alloy Library database, which will be made available to all participating members and via appropriate licensing. Using this data, other computational techniques, such as genetic algorithms and neural networks, shall then be employed in an effort to predict material trends and optimise next-generation combinatorial alloys.

In summary, the selected *Metallurgy Europe* project here is expected to provide the infrastructural foundation for a wide-ranging materials discovery capability in Europe, serving all other *Metallurgy Europe* disciplines. This topic is highly strategic and will serve a large proportion of Europe's technical sectors, including production, transportation, energy, renewables and healthcare.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-10a

Functional Electrochromic Coatings and Glazing

Considerable amounts of energy are consumed each year, managing the heat flow in buildings, offices and homes. For example, expensive, power-hungry air-conditioning systems are often used to extract heat from inside buildings. More cost-effective alternatives are now being developed, including innovations such as 'electrochromic smart glass'.

This type of glazing can change between clear-transparent and dark-translucent at the flick of a switch, thus fine-tuning the flow of heat through the windows. Installing smart glass can create climate-adaptive buildings that are able to lower the costs of heating and air-conditioning and can avoid the need for motorised shutters, blinds and curtains.

The project, being solicited in this call, shall develop and demonstrate smart windows based on electrochromic glazing. Overcoming the present barriers, such as materials, technology and cost, should be a strong feature of this project. New scalable manufacturing methods will need to be developed to sputter and deposit solid-state electrochromic coatings on to large glass panels. A holistic approach is called for, combining fundamental metallurgical research, sputter deposition techniques, process control and device manufacturing, as well as real-world engineering tests. Finally, the electrochromic devices should be scaled-up to demonstrator level and the project should show the feasibility of cost-effective mass production in the near future.

In summary, the selected *Metallurgy Europe* project here is expected to develop, deliver and demonstrate the use of electrochromic glazing for the building and automotive markets. Rapid development in this project could secure European leadership in the field of smart glass production, thereby unlocking major environmental and cost-saving benefits for the global consumer.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-10b

Nanocrystalline Diamond Coatings and Components

Diamond coatings are already well established for niche, low-volume markets, such as drills, cutting blades, surgical scalpels, milling and turning tools. The unique materials properties of nanocrystalline diamond, produced by chemical vapour deposition (CVD) of methane gas, include very high stiffness, hardness and strength, coupled with low density. These are all desirable properties for a wide range of different industry sectors.

However, there are practical barriers still to address before nanocrystalline diamond becomes a mass market material. The deposition process needs accelerating and there is also, at present, a serious lack of suitable metal substrates to grow the diamond on. Overcoming these two problems would represent a major breakthrough in diamond commercialisation.

The project, being solicited in this call, shall therefore study and understand the mismatch of properties (mainly Young's modulus and thermal expansion coefficient) between metal substrates and the deposited layers of diamond. Based on this knowledge, the project is expected to optimise the mechanics and adhesion of the substrate/diamond interface, to ensure good quality deposition with low residual stress. The project shall determine strategies to scale-up and accelerate deposition, whilst reducing energy consumption and waste. The mechanical properties of coated and bulk nanocrystalline parts will need to be systematically assessed, in order to provide reliable data for designers and end-users. Last but not least, industrial demonstration of diamond in different applications is anticipated, including for example: tooling, biomedicine, horology, metrology, sensors and bulk mechanical parts.

In summary, the selected *Metallurgy Europe* project here shall (i) eliminate the technical barriers associated with CVD diamond coatings, (ii) demonstrate several industrial applications and (iii) pave the way for large-scale take-up of this unique and sophisticated material, in Europe and beyond.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-11a

Expanding Structural PM Steel Markets for the Automotive Sector

Automatic transmission in passenger cars is becoming increasingly popular in Europe, due to improved comfort for the driver and the potential to lower fuel consumption. However, modern automatic transmission systems contain large and complex-shaped components that are often difficult and expensive to produce by classical metalworking and forming techniques. New technologies are urgently needed for these kinds of transmission and powertrain parts.

The project, being solicited in this call, shall develop improved steel-based powder metallurgy (PM) techniques with the purpose of exploiting the high material utilisation (>90%) and energy efficiency of the PM press-and-sinter route.

One of the expected outputs of such a project is to demonstrate the capability of producing large numbers of parts with highly complex geometries, with excellent precision, reproducibility and with low porosity levels. The latter could also be exploited by selectively retaining porosity in particular areas of a component, in order to aid lubrication or vibration damping for example. Optimisation of alloy chemistry and heat treatment protocols should also be addressed as part of this project.

In summary, the selected *Metallurgy Europe* project here is expected to expand the steel PM market by delivering new transmission components in large volumes for the automotive sector. These higher-performance PM products will give European industry a competitive edge relative to Far East part-suppliers.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-11b

Novel Powder Consolidation Processes for Large Metallic Parts

In Europe, powder metallurgy (PM) is an important way of making net-shape metallic components, using industrial techniques such as hot isostatic pressing (HIP), metal injection moulding (MIM) and sintering. These PM processes today produce 1.5 million tonnes of parts, and the PM industry has seen annual growth of 7% for a decade.

However, each process has its pros and cons. HIP is suitable for large parts, but is relatively expensive due to canister preparation and removal. MIM is cheaper, but is limited to small-sized parts because of binder removal. And sintering is long-established, but unable to reach 100% density in the final parts when using water-atomised powder. Therefore, new techniques are required that can fill the gaps between these traditional process routes, while at the same time creating further growth in the PM market.

The project, being solicited in this call, shall develop breakthrough processes for powder consolidation of large parts (50-100kg) that are cost-affordable, energy efficient and of excellent metallurgical quality. The feedstock atomised metal powders should ideally be low cost, clean and homogeneous, as well as scalable to very large quantities. Likewise, the compaction processing should be demonstrated in an industrial setting, with large demonstrator parts being manufactured for subsequent end-user assessment. The project should also explore the use of large compacted pre-forms and blanks for other subsequent processes like forging and extrusion. Multi-materials and metal-matrix composites could be an additional topic of interest in this area.

In summary, the selected *Metallurgy Europe* project here is expected to develop breakthrough PM technology that is clean, efficient and affordable, as well as scalable to very large volumes (millions of tonnes). The economic impact of such a new development could be dramatic and would help secure European leadership in powder metallurgy.

Target Project Size: 15-20 M€

European Dimension: Project partners from at least 4 EUREKA member states

Met-Euro-Call-01-2015-12

X-ray & Neutron Characterisation Serving Metallic and Industrial Applications

In addition to the preceding 'product-oriented' calls, a special call is being announced for the development of a large-scale 'service-providing' project dealing with advanced characterisation using synchrotron X-rays and neutrons. Year on year, these tools are becoming more sophisticated and powerful, penetrating deep into the heart of materials. The various beam-lines in Europe are able to provide valuable insight into a material's crystal structure, multi-phase structure, nano-structure, precipitate distribution, residual stress, as well as a host of other physical properties like magnetism. Many of these properties can now be measured as a function of temperature, pressure, gas atmosphere and time (hence, in-situ studies).

The project, being solicited in this call, shall provide a strong industrial linkage with several other selected *Metallurgy Europe* projects, by delivering relevant experimental data from the various X-ray and neutron beam-lines in Europe. The project is also expected to develop new hardware and set-ups that extend the current characterisation capabilities.

The characterisation techniques of most industrial relevance to *Metallurgy Europe* include: (i) in-situ neutron residual stress analysis for AM, welding and deformation, (ii) diffraction and in-situ imaging of melt-pool dynamics, solidification and grain texture, (iii) in-situ diffraction and imaging of solid-state transformations and nano-precipitate evolution during heat treatment and thermal cycling, (iv) fast high-throughput characterisation and phase analysis of bulk and thin-film alloy samples, and (v) in-situ micro-tomography during mechanical testing (tensile, compression, creep, fatigue) and hipping, also at high temperature and under controlled atmospheres. Last but not least, the project should also consider data collection, data analysis and data informatics as a key element.

In summary, the selected *Metallurgy Europe* project here is expected to serve the other industrially-driven projects in the Cluster, by offering world-class X-ray and neutron characterisation techniques that can help industry improve their materials and processes. This will give Europe a competitive edge and allow knowledge-based industrial manufacturing to be promoted for decades to come.

Target Project Size:	N/A
Comment:	Beam-time and support will be provided, in exchange for industrial fees charged to those projects being directly served
European Dimension:	Project partners from at least 4 EUREKA member states