GA TWINN 692216

Deliverable No. 5.1.

Industrial Workshop for innovation guidelines

Contractual delivery date:

31 October 2016

Actual delivery date:

11 November 2016

Partner responsible for the Deliverable: UBU-ICCRAM

Authors: [Iris García Iglesias, Santiago Cuesta López, Sonia Martel Martín]

International Research Center in Critical Raw Materials for Advanced Industrial Technologies (ICCRAM – UBU)

Dissemination level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Document Information Table

Grant agreement no.	692216
Project full title	The VIRTUAL Centre for Integration of INNOVATIVE synthesis and Processing methods for SUSTAINABLE advanced Materials operating under Extreme Conditions-SUPERMAT
Deliverable number	D5.1
Deliverable title	Industrial Workshop for innovation guidelines
Nature	R
Dissemination level	PU
Version	3
Work package number	WP5
Work package leader	ICCRAM-UBU
Partner responsible for Deliverable	ICCRAM-UBU 
Reviewer(s)	Santiago Cuesta López, International Research Center in Critical Raw Materials for Advanced Industrial Technologies (ICCRAM – UBU). Approval Date 08/11/2016.

"The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 692216"

Revision Table

Version	Date	Modified Page/Section	Author	Comments
0	15/10	First draft	Iris García Iglesias	First version of the Deliverable
1	17/10	General revision	Sonia Martel Santiago Cuesta	General revision, formatting.
2	8/11	Conclusions - related to the innovation needs in Material Science for Extreme Conditions Industry	Santiago Cuesta	Specific Objectives and Conclusions Final Revision

Table of Contents

1. Organization of the combined workshop

1. Organization of the combined workshop

The primary ambition of the SUPERMAT project is the creation of a virtual center on innovation of materials for extreme conditions centered around IMNR. In the medium to long term, one main practical objective is the usage of the center to boost IMNR position in Bucharest-Ilfov region, Romania and in the entire EU by increasing the knowledge and the technology degree of innovation potential for sustainable advanced materials operating under extreme conditions.

To achieve this practical goal a networking action was set-up to develop relation along two directions simultaneously:

- towards the world of standardization and EU policy ;
- towards the world of industry, sensitive to materials innovation in the areas of extreme conditions and critical raw materials.

While initially implemented as a two separate actions happening at different times and locations during the project, the Consortium finally resort in the organization of one unique event in the form of workshop, offering a roundtable where all the actors from the two groups were represented and actively engaged. The rationale underlying this choice lays in the recognition that a true innovation initiative, focused on high TRL and market view, need to be designed with an eye to both industry and standardization simultaneously. Aiming at a market-pull type of research, shaping the identity of the SUPERMAT virtual centre around industry and standardization representative is expected to expedite market-uptake of its innovation.

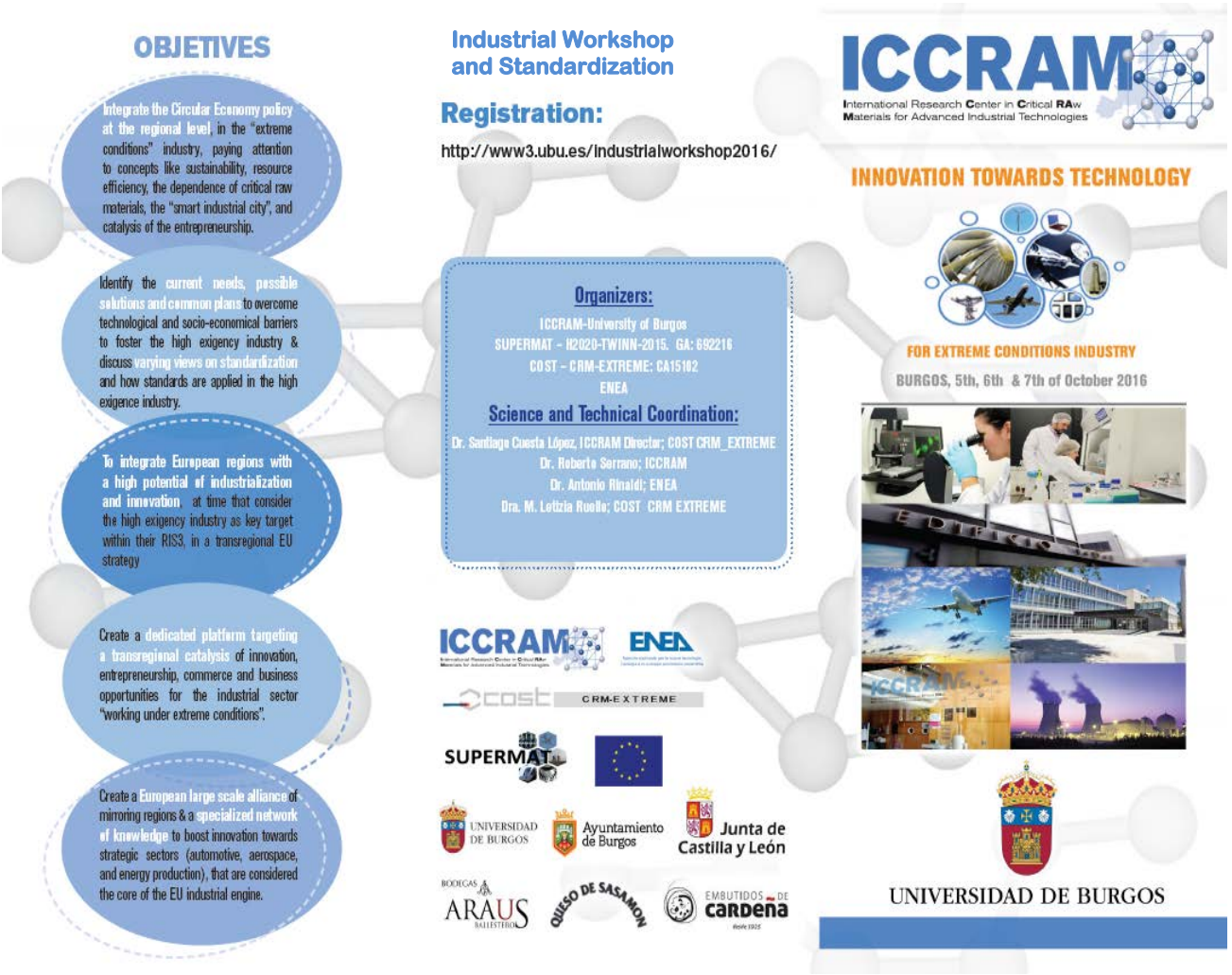
While combined and intermixed in the agenda, these two halves of the workshop are clearly visible, as discussed in Section 4. ENEA and ICCRAM co-organized this workshop, which took place in Burgos on 5th and 6th of October 2016. An extra day (7th October 2016) was used to provide a linkage to another EU action (COST "EXTREME") for added resonance and further networking for SUPERMAT. The description of the workshop and the results are contains into two deliverables D2.8 and D5.1 (foreseen by grant agreement). These consist of two reports differing just in Section 2, to highlight the specific objectives achieved in the workshop against the planned deliverables:

D2.8. Specialized workshop involving experts in EU policy and international standards, which is the part related to experts in EU policy and international standards

D5.1. Industrial Workshop at IMNR for innovation guidelines, which is the part related to the initial industrial workshop to gather the innovation needs of the key identified stakeholders and transfer them to IMNR and SUPERMAT.

The workshop as a whole involved an initial pool of strategic industries identified by IMNR (with support of ICCRAM and ENEA), as well as standardization experts (AENOR, ASRO, CERTIMAC) and RIS3 experts from Romania and the EU, with the intention to serve as a cornerstone for setting-up the Industrial board of SUPERMAT.

Part of the flier used to advertise the workshop throughout Europe is displayed next.


OBJETIVES
Integrate the Circular Economy policy at the regional level, in the "extreme conditions" industry, paying attention to concepts like sustainability, resource efficiency, the dependence of critical raw materials, the "smart industrial city", and catalysis of the entrepreneurship.
Identify the current needs, possible solutions and common plans to overcome technological and socio-economical barriers to foster the high exigency industry & discuss varying views on standardization and how standards are applied in the high exigence industry.
To integrate European regions with a high potential of industrialization and innovation, at time that consider the high exigency industry as key target within their RIS3, in a transregional EU strategy
Create a dedicated platform targeting a transregional catalysis of innovation, entrepreneurship, commerce and business opportunities for the industrial sector "working under extreme conditions".
Create a European large scale alliance of mirroring regions & a specialized network of knowledge to boost innovation towards strategic sectors (automotive, aerospace, and energy production), that are considered the core of the EU industrial engine.
Industrial Workshop and Standardization
Registration:
http://www3.ubu.es/industrialworkshop2016/
Organizers:
ICCRAM-University of Burgos
SUPERMAT - H2020-TWINN-2015. GA: 692216
COST - CRM-EXTREME: CA15102
ENEA
Science and Technical Coordination:
Dr. Santiago Cuesta López, ICCRAM Director; COST CRM_EXTREME
Dr. Roberto Serrano; ICCRAM
Dr. Antonio Rinaldi; ENEA
Dra. M. Letizia Ruello; COST CRM EXTREME
ICCRAM
ENEA
cost
CRM-EXTREME
SUPERMAT
UNIVERSIDAD DE BURGOS
Ayuntamiento de Burgos
Junta de Castilla y León
BODEGAS ARAUS
QUESO DE SASAMON
EMBUTIDOS DE CARDEÑA
ICCRAM
International Research Center in Critical RAw Materials for Advanced Industrial Technologies
INNOVATION TOWARDS TECHNOLOGY
FOR EXTREME CONDITIONS INDUSTRY
BURGOS, 5th, 6th & 7th of October 2016
UNIVERSIDAD DE BURGOS

2. Specific Objectives

The workshop has been organized paying attention to three main industrial sectors that use and require a continuous innovation effort in materials working under extreme conditions: **aerospace, manufacturing, tools/capital goods production, alloys and energy production**.

These sectors have particular peculiarities and needs that guided the design of the event in order to find solutions to the main problems by targeting specific objectives:

- Identify the **main forefront innovation needs and problems for each sector**, within the core of the applied technology and real industrial needs.
- Discuss how the main innovation needs are related to materials science, and how a dedicated development in materials science might answer the challenge.
- Analyze the present operation limitations, gaps and durability problems of commercial and standardized materials in the high exigency industry.
- Discuss the technology readiness level (TRL) of possible innovations, focusing in how to foster the improvement of forefront materials to make their use reliable thus creating a roadmap to raise their TRL.
- Fit the innovation effort within the European Innovation Partnership (EIP) in raw materials Strategic Implementation Plan, in order to develop materials paying attention to the efficient use of resources, and the international dependence on certain Critical Raw Materials (CRMs)
- Align the needs and findings discussed, with the main objectives and conclusions of the European Energy Research Alliance, and the SET roadmap materials for low carbon energies.
- Identify the **current needs, possible solutions and common plans** to overcome technological and socio-economical barriers to foster the high exigency industry
- Create a **dedicated platform targeting a transregional catalysis** of innovation, entrepreneurship, commerce and business opportunities for the industrial sector “working under extreme conditions”.

3. Discussion, conclusions and next steps

Innovation in materials under extreme conditions has clear peculiarities within the different sectors discussed in our workshop. However, within all the sectors analyzed and for all the round table discussions held, it has been pointed out the need to align innovation with the criteria of efficient management of resources (working towards a circular economy approach), and to pay attention to diminish the use of critical raw materials.

In this regard, it is important to align EU programs and promote the interrelation of materials development and new manufacturing technologies to the raw materials policy and the efficient use of resources described as part of the objectives of the social Challenge 5 under Horizon 2020 program.
A well identified sector making remarkable progress in implementing this policy and philosophy is the advanced manufacturing, as MANUKET and Mondragon Corporation showed in their presentation.

Technically, it is very important to highlight the following conclusions common for all the involved sectors:

- New innovations in materials for extreme conditions must advance in synchrony with welding technologies. Innovation into operation will clearly depend on welding and not only in new enhanced molecular (nano/microscopic) properties of the material.

- 3D printing and additive manufacturing are the main axis of innovation with more projection in the next decade.

- Durability at time that improving operation performance are a general need for all the sectors.

- Cross-fertilization with robotics development is needed. From next generation of manufacturing (industry 4.0) up to space exploration and nuclear energy needing of automated operation under extreme conditions.

Next clear steps in materials science, in synergy with accreditation, for both aerospace and energy production, are the development of a new generation of super alloys, working safety and longly at high operation temperatures (i.e. Turbines), and the innovation of new class of light, flexible shielding materials, being specially important the cases of radiation damage shielding and thermal stress resistance.

4. Integrated Workshop Review

INNOVATION TOWARDS TECHNOLOGY

FOR EXTREME CONDITIONS INDUSTRY

Organizers:
ICCRAM-University of Burgos
SUPERMAT – H2020-TWINN-2015. GA: 692216
COST – CRM-EXTREME: CA15102
ENEA

Science and Technical Coordination:
Dr. Santiago Cuesta López, ICCRAM Director; COST CRM_EXTREME
Dr. Roberto Serrano; ICCRAM
Dr. Antonio Rinaldi; ENEA
Dra. M. Letizia Ruello; COST CRM _EXTREME

ICCRAM International Research Center in Critical RAw Materials for Advanced Industrial Technologies
UNIVERSIDAD DE BURGOS
ENEA
CRM extreme
SUPERMAT
Junta de Castilla y León
BURGOS

Executive Summary

The workshop “Innovation towards Technology for extreme conditions industry” took place on 5th and 6th October 2016 at the University of Burgos (Campus la Milanera).

It was organized by ICCRAM-Universidad de Burgos, ENEA, COST Action and SUPERMAT.

The workshop was attended by more than 110 high level participants representing European mining, automotive and aerospace industries as well as European authorities in the topic from different EU countries as Spain, Romania, Finland, Italy and Hungary.

Audience and invited speakers discussed the importance of the high exigency industry and the extreme conditions technology innovation as well as research, development and innovation of technology for engineering under exigent conditions, mainly in four sectors: aerospace, automotive, manufacturing and energy production.

The objectives of the workshop were mainly the following:

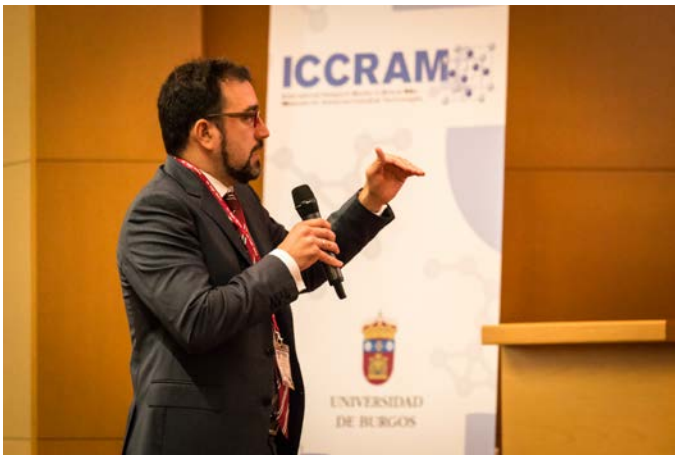
- **To integrate European regions with a high potential of industrialization and innovation,** at time that consider the high exigency industry as key target within their RIS3, in a transregional EU strategy.
- Create a **European large scale alliance** of mirroring regions & a **specialized network of knowledge** to boost innovation towards strategic sectors (automotive, aerospace, and energy production), that are considered the core of the EU industrial engine.
- Identify the **current needs, possible solutions and common plans** to overcome technological and socio-economical barriers to foster the high exigency industry & discuss **varying views on standardization** and how standards are applied in the high exigence industry.
- **Integrate the Circular Economy policy at the regional level**, in the “extreme conditions” industry, paying attention to concepts like sustainability, resource efficiency, and the dependence of critical raw materials, the "smart industrial city", and catalysis of the entrepreneurship.
- Create a **dedicated platform targeting a transregional catalysis** of innovation, entrepreneurship, commerce and business opportunities for the industrial sector “working under extreme conditions”.

These objectives have been successfully covered not only by the different sessions and specialized sessions that have taken place in the workshop but also for the discussions that the audience has had about the themes treated there.

4.1. Institutional opening

The workshop “Innovation towards Technology for extreme conditions industry “was held on 5th and 6th October 2016 at the University of Burgos (Polytechnic School, Campus la Milanera).

The workshop was attended by more than 110 high level participants from different backgrounds representing European mining, energy production, automotive, and aerospace industries as well as European authorities in these fields from different EU countries as Spain, Romania, Finland, Italy and Hungary.



The workshop was opened by the General Director of ICCRAM, Santiago Cuesta López. He invited the audience to dialogue to get the European integration of the regions with a high potential of industrialization and innovation, at time that considered the high exigency industry as key target within their RIS3, in a transregional EU strategy, as a main objective of the workshop. In addition, he emphasized the importance of developing the research in the key sectors as a way to improve results and build a more sustainable industry. This main objective can be achieved through the creation of large scale alliance of mirroring regions and a specialized network of knowledge to boost innovation towards strategic sectors, the identification of current needs, possible solutions and common plans to overcome technological and socio-economical barriers to foster the high exigency industry, the integration of the Circular Economy as a policy at the regional level and the creation of a dedicated platform targeting a transregional catalysis of innovation.

Right after, two key note presentations were chaired by Jose Ignacio Pradas, Technical counselor coordinator in the Spain's Ministry of Economy and Competitiveness and Carlos Martín Tobalina, Industry and Competitiveness General Director in Castilla y León Government.

José Ignacio Pradas Poveda remarked the importance of the high exigency industry and the extreme conditions technology innovation in Europe.

Carlos Martín Tobalina, talked about High exigency engineering as the innovation engine of Castilla y León and the city of Burgos.

During the opening of the second day, Joseba Bilbatua, Senior Manager of Innovation and Technology at Mondragon Corporation, talked about Innovation catalysis in the manufacturing and tool makers industry in the MANUKET platform. Francisco Arribas, Programme Manager on machinery, industrial systems and fuels (Standardization

Department, AENOR) remarked the importance of standardization in the innovation of technology for the automotive, aerospace and manufacturing sessions.

4.2. Specialized Sessions

During the days 5th and 6th took place three specialized sessions with the following topics:

- Specialized session I: Regional Smart Specialization technology development and the extreme conditions industry.
- Specialized session II: Industrial development, standards, technology challenges and needs of the industry working under high exigency: components, tools and machinery industry.
- Specialized session III: Industrial development, standards, technology challenges and needs of the industry working under high exigency. Energy production.

Each specialized session counted on different case studies in countries as Romania, Finland, Italy (Region of Emilia-Romagna) and the participation of different companies from the key sectors.

I. Specialized session I: Regional Smart Specialization technology development and the extreme conditions industry.

This session was celebrated 5th October at 10:15. It had duration of 2 hours and 45 minutes, and it was formed for three different case studies.

The first case study was chaired by Monica Alexandru, Counselor for European affairs National Authority for Scientific Research and Innovation, and treated about the RIS3 strategy in the region of Bucharest-Ilfolv (Romania).

The second case study was chaired by Kristina Jokelainen (Senior Expert of the Regional Council of Lapland) with the collaboration of Vesa Nykänen (Regional Council of Lapland) and was about Regional specialization strategy and clustering high level technology industry (Finland).

The third case study, led by Peter Barkoczy, R&D Manager, Head of the Integrated Quality Assurance System at FUX Co. and lecturer at the University of Miskolc, addressed about the Specialization in the region of the north of Hungary. Miskolc Holding Local Government Asset Management Corporation.

Once the invited speakers finished their presentations, there was a period of conclusions where the audience could ask questions and make conclusion about the topics.

II. Specialized session II: Industrial development, standards, technology challenges and needs of the industry working under high exigency: components, tools and machinery industry.

This session was celebrated 6th October at 10:10a.m. It had duration of 2 hours and 40 minutes, and was formed by presentations made by High level speakers from companies as Hiperbaric, IIS (Italian Institute of Welding), SANDVIK, HONEYWELL and WALTER TOSTO.

These companies introduced its experience in industrial development and standardization, as well as, determined its needs, as a step to get solutions together.

Hiperbaric was introduced by Andrés Hernando, Director of Hiperbaric, talking about techniques and products used by the company and its effects in the high exigency industry.

IIS (Italian Institute of Welding) was hosted by Luca Costa, Director of the training department at IIS Progress, who explained IIS projects and proposes.

SANDVIK was presented by José María Tarrago, R&D engineer in the field of Hard Materials at Sandvik Mining and Rock Technology, who introduced some strategies to deal with cemented carbides production and manufacturing.

HONEYWELL was hosted by Cornel Cobianu, Senior Technology Manager at Honeywell Romania, giving an overview of his company's aims and technological challenges.

Finally, Stefano Rossi, R&D in Narrow Gap - Automatic welding on stainless steel material for critical nuclear applications in WALTER TOSTO, presented his company and its partners, the main projects in which it is involved in, and its future outlooks.

III. Specialized session III: Industrial development, standards, technology challenges and needs of the industry working under high exigency. Energy production.

This session was celebrated 6th October at 12:50. It had duration of 1 hour and 20 minutes, and was formed by presentations made by High level speakers from companies as ENGICER, CIUDEN, and ENSA.

This session was focused on the challenges opened in the production of energy in a sustainability way.

Sandro Gianella CEO of EngiCer SA opened the third session, remarking the importance of solving the needs of the energy production industry working under high exigency.

Iñaki Álvarez, Business Development Director in CIUDEN introduced his company and the projects in which CIUDEN is currently involved.

And last, ENSA was presented by Emma Merino Cué, R&D&I Manager, who closed the session with a presentation dealing with nuclear equipment designed in her company.

4.3. Sessions

During the days 5th and 6th took place three specialized sessions with the following topics:

- European Activity in research, development and innovation of technology for engineering under exigent conditions
- Industrial development, standards, technology challenges and needs of the industry working under extreme conditions: Aerospace
- Standardization in materials and processes for the high exigency industry

Each session counted on different projects and centers presentations and the participation of different companies from the key sectors.

I. European Activity in research, development and innovation of technology for engineering under exigent conditions

This session was celebrated on 5th October at 13:00. It had duration of 1 hour, and was formed by presentations about ICCRAM, SUPERMAT and COST CRM-EXTREME.

Firstly, Santiago Cuesta López introduced ICCRAM (International Research Center in CRMs for Advanced Industrial Technologies), located at Universidad de Burgos facilities, as a competence center exploring the forefront technology for extreme conditions. In addition, he presented one of the main projects of ICCRAM, ICARUS FET-OPEN PROJECT, which propose a new methodology to discover new monocrystalline tailored alloys, capable of exhibit incredible response and self-healing properties under extreme conditions.

SUPERMAT was presented by Radu Piticiescu, PhD in Materials Science at National Institute for Nonferrous and Rare Metals (IMNR, Romania), and explained its main objective which is to create a trans-European Center of Competences to provide innovation service to key well identified in the Smart Specialization Strategy of target EU Region. As a result, the project will boost the research and innovation activity of institute IMNR (Bucharest-Ilfov region, Romania) by increasing the knowledge and technology degree of innovation potential for sustainable advanced materials operating under extreme conditions. Development and understanding of these materials open new opportunities to enhance the competitiveness of regional and National SMEs in priority sectors like: tool making, energy production, aerospace, capital goods and equipment.

COST CRM-EXTREME was hosted by Maria Letizia Ruello (PI of the COST Action, Professor at the Universitá Delle Marche, IT), who explained that the Cost Action is focused on the substitution of CRMs (like Cr, Co, Nb, W, Y) in high value alloys and metal-matrix composites used under extreme conditions of temperature, loading, friction, wear, corrosion, in order to catalyze innovation and ensure critical raw materials independence for the Energy, Transportation, capital goods, manufacturing and Tool making European industries.

II. Industrial development, standards, technology challenges and needs of the industry working under extreme conditions: Aerospace.

The second session had as a main topic the Industrial development, standards, technology challenges and needs of the industry working under extreme conditions applied to aerospace industry.

This session was celebrated 5th October at 16:00. It had duration of 2 hours and 20 minutes, and was formed by presentations made by high level speakers from companies as EMA (Europea Microfusioni Aerospaziali S.p.a.), GMV, DIAD GROUP, AIRBUS and AAC (Aerospace & Advanced Composites GmbH).

The session was started by EMA and leaded by Michele di Foggia (Research and Innovation Manager of European Microfusioni Aerospaziali S.p.a), followed by GMV presented by Juan Carlos Llorente (CEO, Advisor and Robotic Business development from GVM), Sergio Durante (Executive vicepresident of DIAD GROUP), José Manuel González (Quality and Enviromental Department in AIRBUS) and closed by Michael Scheerer (AAC Researcher, Head of polymer compositor Department in Aerospace & Advanced Composites GmbH).

All of them coincide on the importance of finding substitutes for critical raw material to improve the efficiency and the environmental sustainability.

Once the invited speakers finished with their presentations, there was a period of conclusions where the audience could ask questions and make conclusion about the topics treated during the presentations.

III. Standardization in materials and processes for the high exigency industry

This session was celebrated 6th October at 16:30. It had duration of 2 hours, and was formed by presentations made by High level speakers from companies as AENOR (Spanish Association for Standardization and Certification), ASRO (Romanian Association for Standardization) and CERTIMAC.

AENOR/ISO was presented by Francisco Arribas, Programme Manager on machinery, industrial systems and fuels (Standardization Department, AENOR)who remarked the importance of standardization in the manufacturing, components and tool makers sector.

ASRO was hosted by Valerica Korciova, Technical Officer in Standardization at the Romanian Standards Association, talking about exigent conditions and standards in aerospace technology.

CERTIMAC, introduced by Luca Laghi, MSc. Eng L. Laghi | Technical Manager of the Company, made a presentation about the accreditation importance in the Energy sector.

At the end, the invited speakers and the audience made a summary of needs of the energy, manufacturing sector. Discussion about how to integrate the innovation needs into the regional policy and boosting policy.

4.4. Edited book of abstracts (In publication process)

Case study: The regional research and innovation strategies in Emilia-Romagna, Italy: an aerospace engineering perspective

Talamelli, Alessandro [1]

[1]Interdepartmental Centre for Industrial Research (CIRI-Aeronautics), ALMA MATER Studiorum, University of Bologna

e-mail: alessandro.talamelli@unibo.it

The Smart Specialization Strategy (S3) is a tool used throughout the European Union to improve the effectiveness of public regional policies for research and innovation. Through its S3 the Emilia-Romagna Region has built a strategic framework aiming at strengthening the competitive and employment growth of the regional economy. The S3 is implemented in the High Technology Network, created in 2008 and composed of more than 80 laboratories (mostly public but also private), 13 Centres for Innovation distributed in 6 platform and 9 Technopoles. S3 identifies the priority areas of research and innovation on which to intervene and the objectives to be achieved for the regional economy as a whole. At the same time, it declines the synergies with the world of research and that of training, as well as - for example - with the themes of 'environment and sustainable development, new technologies and ICT, health and tourist attractiveness. The strategy in Emilia Romagna identifies five major production areas: 3 of them - Agrifood, Mechatronics and Transporting Systems, Construction - are the current pillars of the regional economy, the other 2 – Life Sciences and Health, Culture and Creative Industries represents areas with high potential for growth in the production system. The strategy identifies also the main technological and organizational factors on which it is necessary to play in order to ensure competitiveness and growth to the production system, the drivers of innovation in the Region and the key enabling technologies which are of fundamental importance for the development of new growth trajectories. Finally, the Interdepartmental Centre for Industrial Research in Aerospace Engineering of the University of Bologna will be introduced as an example on how the strategy is implemented in this particular field. Examples of products and patents developed will be described and an example of start-up, born in this context, will be presented.

Standardization in welding of innovative materials for high exigency applications

Costa, Luca

[1]IIS PROGRESS srl, Lungobisagno Istria 15, 16141 Genoa (Italy)

e-mail: luca.costa@iisprogress.it

Technical standardisation needs for materials in energy sector is a cross-cutting issue due to the wide factors involved in standardisation process and in innovation and industrialisation stage. In order to probe this topic, a brief introduction on the main standardisation issues is necessary. Indeed, between research, standardisation and market, a permanent gap is unfortunately present due to the different timing between R&D activities, standardisation process and market launch of new products/solution. At this regard, a brief overview of "standardisation processes" is necessary to understand how to birth a new technical standard, who are the interested parties supporting a new technical standard development and which are the main steps of "typical process of standardisation" at European level. During the process many different phases have to be considered: from proposal to the final adoption and publication. Moreover, after the preliminary acceptance of the proposal, a drafting stage is developed by appointed experts (working groups and ad hoc groups) designate by the Technical Committees. During this phase, Working Group are established in order to:

- assess new test methods and activate joint international research activities (e.g. Round-Robin tests)
- fine-tune/validate experimental existing methodology

This single phase could last much more than three years (reference period of time for standardisation process[1]) due to technical issues, joint research activities, step-by-step approach, etc. During this period of time, meanwhile, Industries, Markets and Research activities proceed forward and it grows-up a characterisation/certification need on the innovative solution developed. At this stage the role of an Accredited research Laboratory is crucial to estimate the performance of a new material subjected to extreme conditions to answer to precise "business pains" through ad hoc experimental activities according to:

- technical standard in drafting stage
- new experimental procedures taking into account materials typology/characteristics and its final intended use. Moreover, also existing standards developed for "similar" materials or intended uses could be borrowed

In order to better understand this "role" and the action plan which has to be considered, two case-studies are presented to show the approach implemented to give precise answers to a precise need "uncovered" by a specific technical standard.

Footnote references: [1] CEN – European Committee for Standardisation.

From Advanced To Engineered Ceramics: Optimization of Cellular Structures

Gianella, Sandro

EngiCer SA, Viale Pereda 22, 6828 Balerna, Switzerland

e-mail: sandro@engicer.com

Technological advancement increase the demand for better performing materials, with no exception for the field of cellular ceramics. The performance of cellular structures depends on bulk material properties and on their structures. Thus, along with material optimization, structure optimization represents a crucial factor for the final performance of cellular materials.

The present work focuses on cellular high temperature ceramics optimization, driven in these cases by the need of specific thermo-mechanical and fluid dynamic performances of the component, in which the long and expensive prototyping phase is entirely carried via computer simulation. This allows shortening the development of the component and starting its testing phase on its quasi-final configuration.

To show the feasibility of this approach some case-study will be presented in the hydrogen generation and concentrated solar energy fields. It starts from common random foam structures, to end up with structures first digitally optimized and then produced by rapid prototyping of the template and replication.

SUPERMAT: a virtual center for sustainable development of advanced materials operating under extreme conditions

Radu R. Piticescu1, Santiago Cuesta-Lopez2, Antonio Rinaldi3, Marina Urbina4, Yi Qin5, Peter Szakalos6, Alain Largeteau7

[1]National R&D Institute for Nonferrous and Rare Metals, Pantelimon, Romania

[2]University of Burgos – International Research Centre in Critical Raw Materials, University of Burgos, Spain

[3]Agenzia Nazionale per le Nueve Technologie, l'Energia e lo Sviluppo Economico, Rome, Italy

[4]Commisariat à l'Energie Atomique et aux Energies Alternatives, Laboratoire d'Innovation pour les Technologies des Energies Nouvelles (LITEN), Grenoble, France

[5]University of Strathclyde, Glasgow, UK

[6]Kungliga Tekniska Hoegskolan, Stockholm, Sweden

[7]CNRS, Université de Bordeaux, ICMCB, 87 avenue du Dr. A. Schweitzer, Pessac, F-33608, France

e-mail: rpiticescu@imnr.ro

Development and understanding of materials behavior under extreme conditions open new opportunities to enhance the competitiveness of SMEs in priority domains such as machinery and equipment sector as well as to help in the rational utilisation of critical materials.

The SUPERMAT virtual centre developed by 7 Research Centres from France, Spain, Italy, Sweden, UK and Romania with recognised expertise in advanced materials and processing technologies will foster the progress in these fields by: (1) improving existing modelling and simulation tools for ab-initio design of novel multifunctional materials for extreme environments; (2) select case studied materials with high application potential; (3) propose best available technologies for selected materials; (4) elaborate characterisation methods to be certified for future standardisation, (5) propose the European curricula for PhD students in the field of materials for extreme conditions and (6) proposing joint collaborative research projects for H2020 calls as well as contributing to the strategy of EIT Nanofutures and Critical Raw Materials.

Applications presented include: molecular dynamics modelling of smart doped materials to replace CRMs, integration of soft chemical procedures for synhtesis and deposition of doped perowskites, batteries for extreme conditions, ODS materials for energy, special processes for field assisted sintering nanocomposite materials with reduced rare earth elements.

The challenge of CRM-EXTREME

Ruello, Maria Letizia

Università Politecnica delle Marche

e-mail: m.l.ruello@univpm.it

Difficulties in the access to critical raw materials (CRMs) are expected to depress industrial sectors vital to European Union (EU). If direct substitution of CRMs represents an obvious solution (not at all easy to achieve), a more realistic option relates to a combination with rational use, enhanced recycling and sustainable mining.

CRM-EXTREME [1] is a COST Action [2 - 4] focuses on the substitution of CRMs (like Cr, Co, Nb, W, Y, and other rare earth elements) in high value alloys and metal-matrix composites used under extreme conditions of temperature, loading, friction, wear, corrosion, in Energy, Transportation and Machinery manufacturing industries. This will strengthen EU competence to gain the leadership in efficient use of raw materials, to achieve what is foreseen in the EU roadmaps towards 2050 [5]. EU can count on its excellence in areas of knowledge crucial to CRMs, while its high-tech Small-Medium Enterprises (SMEs) and automotive, aerospace and energy industries can ensure suitable innovation paths from labs to market.

Under these circumstances, the Action is the perfect tool for coordinating the ongoing fundamental and applied research, for catalysing strategic advances, and for strengthening the interaction between research institutions, SMEs and industries. The Action aims to set up a network of expertise to define the current state of knowledge and gaps in multi-scale modelling, synthesis, characterization, engineering design and recycling that could find viable alternatives to CRMs and promote research lines and activities for new collaborations and joint research projects for the industrial exploitation of substituted materials.

Footnote references:

[1] http://www.crm-extreme.eu

[2] http://www.cost.eu/about_cost

[3] http://www.cost.eu/COST_Actions

[4] http://www.cost.eu/COST_Actions/ca/CA15102

[5] *http://www.roadmap2050.eu/reports*

Technology challenges and needs in the investment casting foundry: some case study

Di Foggia Michele,

[1]Europea Microfusioni Aerospaziali SpA

e-mail: difoggia@emaht.com

Among the challenges and the most important needs for a lost wax foundry there is the time necessary for the development of new components and the need for materials with higher performances, suitable to work in critical working conditions and that require the processes of transformation and a their use at high temperatures, such as superalloys and ceramics.

The work is therefore focused on some case studies concerning in particular: 1) the innovative technologies for the manufacture of steel die using DMLS technique and 2) the role of materials (and related processes) most significant for the lost wax foundry, such as superalloy used for the manufacture of turbine blades, and the ceramic cores for the manufacture of the internal cooling channels

Footnote references:

Physicist, 47 years old, After 6 years of the experience gained in large companies, mainly in the microelectronics and mechanical industries, since 2004 he is responsible for the R & D in EMA: in addition to the elaboration of programs and activities, he is the scientific & technical coordinator of complex research projects, also made in the form of public-private partnership with other Enterprises, Universities and Research companies.

Development of autonomous critical systems. Case study: Space robotics software and synergies with the oil and gas domain

Llorente, Juan Carlos

GMV Innovating solutions

e-mail: jcllorente@gmv.com

The current European research program related to space robotics is aiming to increase the maturity of space robotics technologies and demonstrate them in the 2023-2024 time frameworks with sizeable demonstration missions. Under this view it is promoting the design and development of building blocks, with the goal of producing reliable, dependable and high performance subsystems, components, and software that can be used at later stages for the composition of robotic concepts.

GMV is actively working in this area developing autonomous critical system able to cope with the incertitude of the stringent conditions found within the space scenarios. Such harsh environments required not only reasoning systems able to properly execute predefined plans but also being capable of reacting to unexpected events and changing conditions. This challenging condition implies a very reliable and robust control operating system with adequate features and performances of space-grade RAMS (Reliability, availability, maintainability and safety).

These space robotics technologies are well suited for other difficult environments like the oil&gas domain, the nuclear sector and other areas like miner or underwater activities. As an example of technology transfer from the space domain, GMV is currently working on the first autonomous robot for industrial oil and gas platforms.

Industrial development, standards, technology challenges and needs of the industry working under extreme conditions: Aerospace.

Scheerer, Michael [1], Mozdzen, Grazyna [1], Merstallinger, Andreas [1]

[1]Aerospace &Advanced Composites GmbH

e-mail: michael.scheerer@aac-research.at

Materials used for space applications are not different to materials (metals, composites ceramics) used in other fields. However materials in space have to survive the harsh environment in space such as atomic oxygens, high energetic particles, ionization radiation, space debris and micro meteorites and high and low temperatures where the conditions change with the individual space missions. Therefore a number of tests following dedicated standards (ECSS) have to be done, when new materials are planned to be used in space applications.

Aerospace & Advanced Composites GmbH works for the European Space Agency (ESA) since more than 25 years as external materials test house. Within this talk examples of space relevant tests performed at AAC for the introduction of new materials in different space applications such as cryogenic tanks [1], planetary exploration [2] or mechanisms such as gears [3] will be shown.

Importance of standardization for technological innovation

Arribas Martin, Francisco Luis

e-mail: farribas@aenor.es

I started my presentation explaining what AENOR as National Standardization Body in Spain is. Then I followed with the definition of Standard and the main differences between Standards and Regulations (laws). It was very important to explain the main characteristics of a standard, like Openness, transparency, consensus, availability, recognition and sustainability.

Following this, the speaker pointed how Standardization supports Innovation through strategic documents of European Union and Horizon 2020 programs.

The targets in this field are basically two:

Consider existing standards when planning and running the project.

Use project results to generate new standards

The purposes of these actions are benefits for researchers and innovators and of course for funders (e.g. European Union).

Standardization in Innovative Materials for Extreme Conditions

Rinaldi , Antonio

Affiliation ENEA, SSPT-PROMAS-MATPRO lab, CR Casaccia,Via Anguillarese 301, 00123, Roma

e-mail: antonio.rinaldi@enea.it

The quest for innovative materials in Europe is directed towards the grand challenges that need to be overcome to insure prosperity and security of our society. This commands that research and development activities and material innovation have to be driven and focused, for example, on:

- grand challenges from sustainability (e.g. renewables, CO2 capture);
- prolonged service life of components and plants (e.g. tooling, power plants);
- KETs .

While free-form R&D is not out of scope, most emphasis when investing public money is certainly placed upon removing industrial bottlenecks and materials technologies closer to the market, i.e. with higher TRL. In this context, the EC has made very clear in the current framework research program (HORIZON2020) that standardization is part of the winning recipe of materials innovation. Materials uptake by industry and society, as well as market acceptance, is crucially tied the successful completion of standardization activities as early as possible in the R&D cycle of a new material. This is part of the current paradigm of materials research in the EU, also for materials for extreme conditions in Aerospace, Nuclear, and Energy and Manufacturing industries.