EUROPEAN VIRTUAL INSTITUTE ON
KNOWLEDGE-BASED MULTIFUNCTIONAL MATERIALS AISBL

KMM-VIN Newsletter

Issue 4, July 2011

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EDITORIAL

We are presenting the new Issue (Summer 2011) of the Newsletter of the European Virtual Institute on Knowledge-based Multifunctional Materials (KMM-VIN).

The Institute was established in 2007 as the main achievement of the Network of Excellence KMM-NoE (FP6). The legal status of KMM-VIN is that of Belgian international non-profit association (AISBL). KMM-VIN AISBL is registered in Brussels and comprises currently 38 core and associated members (research centres, universities, industry and SMEs) from 13 European States.

KMM-VIN offers integrated basic and applied research, educational and innovation activities in the field of advanced structural and functional materials.

The Summer Issue 2011 of the Newsletter contains the usual columns and one special article in the column "Cooperation" written by the Guest Contributors – the Coordinators of the project MUST (FP7) where KMM-VIN is a partner in the consortium.

The most important part of each KMM-VIN Newsletter are the news from the Working Groups: WG1: Intermetallics, WG2: Composite Materials, WG3: Functionally Graded Materials and WG4: Functional Materials.

In the column "KMM Projects" you can find updates from the European projects and selected national projects where KMM-VIN members are involved in. Special attention is given to FP7 projects coordinated by KMM-VIN: MATRANS (Micro and Nanocrystalline Functionally Graded Materials for Transport Applications) and the newly accepted INNVIN ("Innovative materials solutions for Transport, Energy and Biomedical sectors by strengthening integration and enhancing research dynamics of KMM-VIN").

The column "Cooperation" contains updated information on KMM-VIN's activity in the European Technology Platform on Advanced Engineering Materials and Technologies (EuMaT). Also, as already mentioned, an extended article introducing the MUST project ("Multi Level Protection of Materials for Vehicles by Smart Nano-containers") is published in this column. It is sort of a feature article on corrosion protection by smart nanocontainers - a hot topic in contemporary materials research with MUST consortium being one of the leading groups in this field in Europe.

In the column "Research Fellowships, Trainings, Research Positions" the results of the 3rd Call of KMM-VIN Research Fellowships programme are given. This time the programme was combined with the "Offer-Search" action (see the top of the "News from the Working Groups").

The former Summer Schools of the KMM-NoE project will be reactivated in cooperation with the International Centre for Mechanical Sciences (CISM), Udine, Italy. The first KMM-VIN Advanced Course on tissue engineering mechanics has been accepted and will be included in the CISM programme as a regular course for 2012.

In "Personalia" some success stories, awards, distinctions and special assignments of our Colleagues are presented.

The contact details of the KMM-VIN offices are given at the end of the Newsletter. For viewing the details of KMM-VIN members' profiles and information on current events the Readers are requested to visit our webpage www.kmm-vin.eu.

Marek Janas, Editor

LATEST NEWS

GENERAL ASSEMBLY

The 6th General Assembly Meeting (Annual GA Meeting 2011) was held on 22nd February 2011 in Brussels, convened by the KMM-VIN Chairman J. Eberhardsteiner and chaired by the Vice-Chairman F. Rustichelli. Representatives of 26 out of 34 core members (institutions and individual) were present. The Annual Report of the Board of Directors on KMM-VIN activities in 2010 (by M. Basista, CEO) as well as the report on 2010 accounts and 2011 budget (by K. Dolinski, KMM-VIN Secretary and B. Marchand, KMM-VIN accountant) were presented. The General Assembly approved the 2010 accounts and the 2011 budget.

In the technical part of the Meeting the coordinators of the Working Groups: Andreas Chrysanthou Christian Hellmich, Monica Ferraris (representing Aldo Boccaccini) and Thomas Weissgärber reported about the activities of their WGs' with special attention on the running EU projects. The Minutes of the 2011 Annual GA meeting are available for viewing in members' area of the KMM-VIN website.

INNVIN

This FP7 CSA proposal with the full title "Innovative materials solutions for Transport, Energy and Biomedical sectors by strengthening integration and enhancing research dynamics of KMM-VIN" (INNVIN) submitted by KMM-VIN as coordinator on behalf of 21 members has been accepted by the EC and ranked 1st of all other proposals submitted by the former NMP Networks of Excellence to this Call.

By putting this note in the Latest News column we would like to stress the point that INNVIN may be consequential for the future of the whole KMM-VIN. Firstly, in the INNVIN project we had to declare industrial sectors KMM-VIN will target at. These are Transport, Energy and Biomedicine. Secondly, INNVIN's main objective is to work out effective ways to present KMM-VIN offers to the industry and win industry funded projects for KMM-VIN members. All that should contribute to the financial viability of KMM-VIN AISBL in the long run. Clearly, INNVIN may have an effect on the present structure of the Working Groups – a topic that we started discussing at the 2011 GA Meeting in Brussels last February. Even though the EC contribution (444.000 €) is rather modest for this consortium size, we believe it will strengthen integration within partnership and enable expansion towards the industry. The INNVIN project is simply in the best interest of the KMM-VIN members, as it is supposed to bring new funding. Nobody said it is going to be easy but we are confident that the experienced partners of INNVIN consortium will succeed with this challenging project during the next 3 years (see also "KMM projects").

RECENT EVENTS

MATRANS (FP7), a cooperative research project coordinated by KMM-VIN (see also "KMM Projects") completed the first half of its duration with the M18 (mid-term) meeting in Warsaw on 7-8 July 2011.

3rd iNTeg-Risk Conference 2011 on "Risk vs. Risk: Managing emerging risk tradeoffs in complex systems" was held in Stuttgart, 6-10 June 2011.

GlaCERCo Initial Training Network coordinated by POLITO (see the column "KMM Projects") held its kick-off meeting on 15 February 2011 in Turin**.**

FORTHCOMING EVENTS

EUROMAT 2011. European Congress on Advanced Materials and Processes will be held in Montpellier, 12-15 September 2011; http://euromat2011.fems.eu/. For the multiple involvements of the KMM-VIN members in EUROMAT 2011, see "Personalia"

E-MRS 2011 FALL MEETING will be held, as always, in Warsaw, 19-23 September 2011, hosted by Warsaw University of Technology, The Meeting will include 13 parallel symposia, plenary session and some satellite events. http://www.emrs-strasbourg.com

FUMAT 2011 ("Future Materials for Grand Challenges of our time"), 22-23 September 2011, Warsaw, http://www.fumat2011.eu. FUMAT 2011 is an accompanying event of the Polish presidency of the EU devoted to the status and prospects of advanced materials research, funding and international cooperation. KMM-VIN core members IPPT and WUT as well as KMM-VIN itself are involved in its organisation.

MANUFUTURE 2011 ('West and East Europe in global High Added Value manufacturing - facts of today and challenges of tomorrow"), 24-25 October, 2011 (Wroclaw), http://www.manufuture2011.eu – another accompanying event of the Polish presidency of the EU (devoted to manufacturing).

KMM-VIN Advanced Course at CISM
A one-week KMM-VIN Advanced Course on "Skeletal tissue engineering mechanics, with links to biology, chemistry, and medicine", coordinated by Christian Hellmich (TUW) and Aldo Boccaccini (FAU) will be held at CISM (Udine, Italy), 17-21 September 2012.

WHAT'S NEW IN WORKING GROUPS?

"OFFER–SEARCH": A tool to stimulate research collaboration within KMM-VIN outside the EU projects.

This brokering initiative which started in 2010 is aimed at launching or extending the research collaboration between the members of KMM-VIN by providing them with necessary information in order to match partners to do research of mutual interest.

The concept behind this initiative was to collect information from the KMM-VIN members offering some kind of expertise (Offer) while looking for some other type of expertise/testing (Search) within KMM-VIN partnership.

The "Offer-Search" database can be used by the KMM-VIN members to identify and contact potential partners interested in bilateral cooperation on specific topics in form of joint projects, co-supervised diploma, master, or PhD theses.

The "Offer-Search" database is now linked with the KMM-VIN Research Fellowships Programme as it constitutes a useful and steady source of information for the applicants to the Research Fellowships Calls.

The "Offer-Search" database combined with Research Fellowship Programme can be a valuable instrument to carry out joint research (through exchange of young researchers) complementing the cooperative EU research projects, which for obvious reasons, cannot include all KMM-VIN members in the consortia.

The proposals to the "Offer-Search" database should be sent to Michal.Basista@kmm-vin.eu and will be placed under: http://www.kmmvin.eu/Collaboration, a page to be updated regularly.

NEWS FROM WG1: INTERMETALLIC

Research activity in WG1 has continued mainly in the JOINING task. The work is concerned with the development of a glass-ceramic sealant for solid-oxide fuel cells (SOFCs) and aims to hermetically seal the Crofer 22 interconnect and yttria-stabilised zirconia (YSZ) which acts as the anode-supported electrolyte (ASE). The investigating partners in the JOINING task are POLITO, UH and AGH-UST. During the last six months the work has focused on the characterisation of samples that were heated for 3000 hours at 800°C. The Crofer 22 had been pre-treated at 900°C for two hours (our previous work provided evidence that samples pre-treated at 900°C show diffusion of both Cr and Mn into the glass-ceramic sealant during subsequent treatment at 800°C). The treatments were carried out in muffle furnaces in atmospheric air. Three heat-treatments were conducted; (i) continuous heating at 800°C (ii) thermal cyclic treatment involving slow cooling in the furnace from 800°C to room temperature every 72 hours (the cooling down time took 24 hours) and (iii) fast cooling from 800°C by taking the alumina crucibles holding the samples out of the furnace every 72 hours for one hour and then putting them back. The samples for all three treatments showed very similar characteristics. The joints between the glass-ceramic and the Crofer 22 on one side and the YSZ on the other suffered no damage at all and remained intact. It was also observed that both chromium and manganese diffused upto about 10µm into the glass ceramic. At the same time both sodium and calcium diffused away from the chromium and manganese thus preventing any adverse reaction that could form the volatile $Na_2Cr_2O_7$. As observed previously, aluminium which is present as a minor constituent of Crofer 22 had diffused to just below the chromium-manganese oxide pre-oxidised layer and initially formed small pockets of aluminium oxide. As the heat-treatment time increased, the Al_2O_3 became associated with small pores which developed due to the diffusion of Cr and Mn into the glass-ceramic. In some cases these pores broadened (usually to about 5µm) along the length of the interface between the Crofer 22 and the sealant. On rare occasions they extended to 20-25µm just below the surface of the pre-oxidised layer as shown in Figure 1. In spite of this, there was no evidence of failure or spallation of the pre-oxidised layer and no failure at the interface between Crofer 22 and the glass-ceramic. A new paper is under preparation based on the work which is reported here, while another paper by the

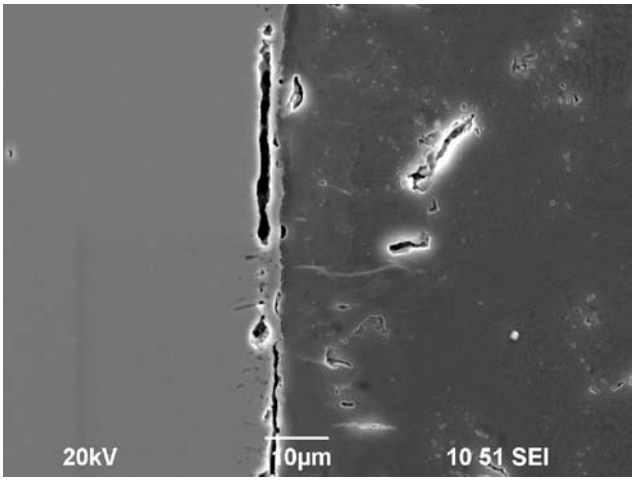


Figure 1. *Broadening of porous areas beneath the Crofer 22 protective oxide layer.*

partners has been accepted for publication by the International Journal of Hydrogen Energy.

Work has also continued on an investigation on the effect of electromagnetic fields on the corrosion resistance of structural metals. The most recent work has shown that the use of high frequency electromagnetic fields significantly improved the corrosion resistance of 0.4%C steel. As from the 1st of July 2011, this work will continue as a Marie Curie In-coming Fellowship titled "Application of Electromagnetic Fields for Enhancement of Structural Metal Performance" (EMFforMET). Under the scheme, Dr Anatoly Babutski (IPSUA) will join the UH for 24 months. The dissemination of the results via the KMM-VIN is one of the contractual obligations of the project so more will be reported in the next Newsletter.

Andreas Chrysanthou, WG1 Coordinator

NEWS FROM WG2: COMPOSITES MATERIALS

Do Carbon Nanotubes Toughen Brittle Matrices?

A recent paper [1] co-authored by Aldo R. Boccaccini in collaboration with colleagues of Queen Mary University of London (F. Inam, M. Reece), Imperial College London (J. Cho, M. Shaffer) and Czech Academy of Sciences (Z. Chlup, I. Dlouhy) discusses the potential of multiwalled carbon nanotubes (CNT) as reinforcing elements in brittle matrices.

An ideal model CNT-brittle matrix composite system, based on a silica glass incorporating well-dispersed CNTs at concentrations of up to 15wt% was fabricated which allows a direct assessment of the effect of CNTs on fracture toughness (K_{IC}). A novel colloidal heterocoagulation process followed by spark plasma sintering was used to fabricate the composites. K_{IC} measurements using both indentation and notched beam techniques showed a linear improvement of fracture toughness with CNT content, up to a two-fold increase at maximum loading. Considering the reported controversy in the literature regarding the appropriateness of different toughness measurement methods for such nanocomposites, the results presented in ref. [1] on CNT/glass composites show equivalent trends but differing absolute values using each technique. The possible toughening mechanisms induced by the presence of CNTs, including CNT pull-out, crack bridging, and crack deflection, were identified. A discussion of toughening mechanisms based on conventional short-fibre composite theory is presented. The authors point out that further work on exploiting CNTs for toughening brittle matrices should concentrate on identifying new mechanisms based on distinctive characteristics of CNTs, such as small diameter, high strength, or unusual morphology. It was also indicated that a wide range of other functional properties remain to be studied in these, and other related, nanotube-filled inorganic matrix systems. Current research projects led by Prof. M. Shaffer (Imperial College London) in collaboration with Prof. A. R. Boccaccini focuses on gaining further understanding on the correlation between processing, microstructure and functional properties of CNT/glass composites.

[1] Cho J., Inam F., Reece M., Chlup Z., Dlouhy I., Shaffe, M.S.P., Boccaccini A.R., Carbon nanotubes: do they toughen brittle matrices?, *J. Mater. Sci.* 46 (2011) 4770–4779.

Nanostructured Thermal Barrier Coatings by Suspension and Solution Plasma Spraying

Thermal spray techniques, such as atmospheric plasma spraying (APS), are convenient methods for preparing nanostructured coatings, as they are widely used in industry. However, nanoparticles cannot be sprayed directly (owing to their low mass and poor flowability) and need to be agglomerated before spraying. Resulting granules can be deposited in the same way as their conventional counterparts. Yet, further effort is necessary in order to optimize the coatings parameters and preserve part of the initial nanostructure in the final coating. Such problems can be overcome by using a liquid feedstock instead of a powder. This novel coating method is known as suspension or solution plasma spraying (SPS).

ITC is now leading a project, supported by the Spanish Government (MAT2009-14144-C03), which is aimed to develop high-performance nanostructured coatings by SPS that can be scaled up to an industrial level. It is intended to find a comprehensive solution, since the project includes the preparation of nanometric precursors, their conditioning as concentrated solutions or suspensions, the transformation of the solution or suspension into the final form (coating) and the characterisation and evaluation of the properties of the coatings obtained by plasma spray.

One of the studied materials is ZrO_2 stabilised with Y_2O_3 (YSZ) for application in advanced thermal barrier coatings (TBC), particularly used in energy or engine-related applications. Actually, the microstructure of SPS coatings is especially appropriate for this application, for the following reasons:

- controlled porosity is obtained,
- vertical cracks appear throughout all the thickness of the coating associated with the presence of semi-pyrolised areas during the deposition,
- absence of own edges of large-sized splats typical of conventional spraying.

In this case, both YSZ nanosuspensions and precursor solutions are investigated in order to obtain TBC. For the preparation of the solutions, mixtures of Zr and Y salts in water have been used,

and for the preparation of the nanosuspensions, commercial YSZ powders have been dispersed and stabilized in water. Both feeding liquids have been developed and are ready for deposition.

The incorporation of these liquids into the plasma torch will take place by pulverisation, generating a drop size distribution that will need to be optimised. A specific injection system has been fabricated by ITC (Figure 2), in the framework of this project and will be used in the next months in order to obtain high performance TBC on superalloy (INCONEL 718).

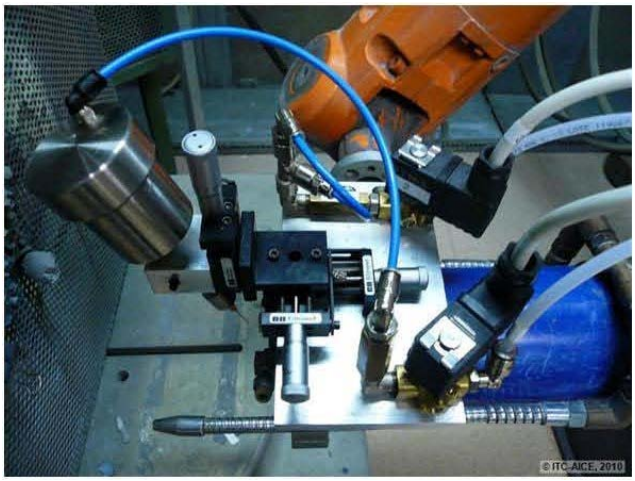


***Figure 2**. Suspension plasma spraying injection system (Enrique Sánchez Vilches, ITC)*

Metal-ceramic composites for aerospace and automotive applications

The MMC, CMC, infiltrated metal-ceramic composites (IPC) as well as nanostructured composite coatings on metal or ceramic substrates have been used in the transport sector for the last several decades with mixed success. Nevertheless, these advanced materials are still attractive for aerospace and automotive industries what can be clearly discerned when perusing the recent EU Framework Programmes. In Poland there is a key project KomCerMet ("Metal-Ceramic Composites and Nanocomposites for Aerospace and Automotive Industry") going on funded by the EU Structural Funds, coordinated by IPPT and involving four other KMM-VIN members (ITME, WUT, AGH-UST, IMIM). The KomCerMet project is organized along the classical KMM research methodology comprising different processing techniques (*inter alia* sintering under pressure, pressure assisted infiltration of molten metal into porous ceramic performs, magnetron sputtering) characterization of their microstructure (e.g. Figure 3) and properties, and modeling of their behavior under service conditions.

Aldo R. Boccaccini, WG2 Coordinator

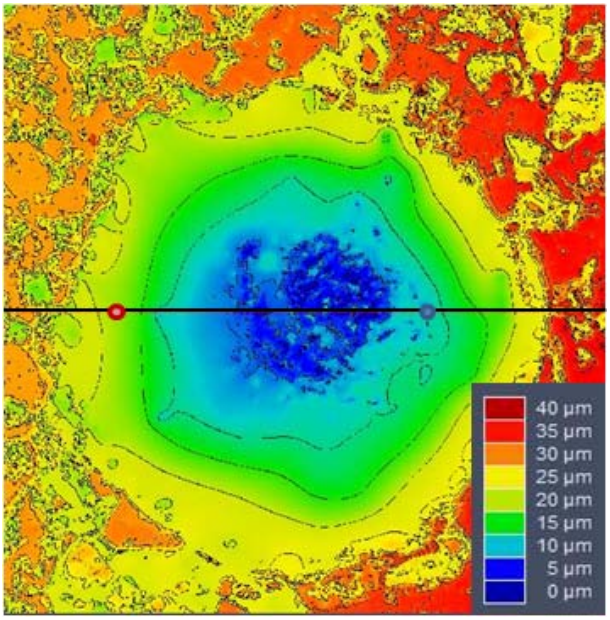


***Figure 3.** Confocal laser scanning microscopy (CLSM) analysis of a spherical pore in interpenetrating Al2O3-Cu composite(Jerzy Morgiel, IMIM)*

NEWS FROM WG3: FUNCTIONALLY GRADED MATERIALS (FGM)

As promised in the last edition of the Newsletter, it is time to tell a little on what is going on in BIO-CT-EXPLOIT, a project realized by the KMM-VIN partners TUW, UNIVPM, and WUT, in cooperation with one additional academic partner and four SMEs being active in the fields of CT scanner production, image-to-mesh conversion, Finite Element and structural simulation technology, as well as orthopaedic biomaterial production. Entering into the last quarter of its entire duration of two years, this project has seen the academic partners overcoming key challenges in transferring latest scientific and technological know-how in image analysis, X-ray physics, and micromechanics, to the SME partners, fulfilling partner-specific requests, with focus on orthopaedic and dental applications. Developed image correction software is characterized by a high level of automatization, giving kind of an „intelligent" tool into the hands of the users, which, from distribution characteristics of the attenuation values, discerns regions and objects of interest, and removes artifacts deteriorating the contrast properties of the image. Such contrast-enhanced images are then translated into nanoporosity and chemical compositions distributions, the latter being the foundations to derive, from micromechanics, stiffness properties over the scanned objects. This widens, on the one hand, the portfolio of scanner-in-built software for image analysis, and on the other, allows for more precise and reliable structural analyses when converting the images into meshes and structural models. In anisotropic bony organs, the latter may need additional topological information on „inner" organ structures, which are also provided in the project for dental applications. And the program is completed by „real" mechanical testing

of the simulated structures, which may be intriguingly small, as e.g. in case of millimeter-sized ceramic globules for bone defect filling (see Fig. 4). For more information, visit bio-ct-exploit.imws.tuwien.ac.at.

Crossing borders has been a permanent trademark of partners involved in WG3 – and while the interface from engineering to life sciences continues to play an important role, it is thanks to a unique initiative of Prof. Franco Rustichelli (UNIVPM) that the border from science to the *arts* has been crossed recently (see ISWA in "KMM Projects"). More about that in one of the upcoming Newsletters.

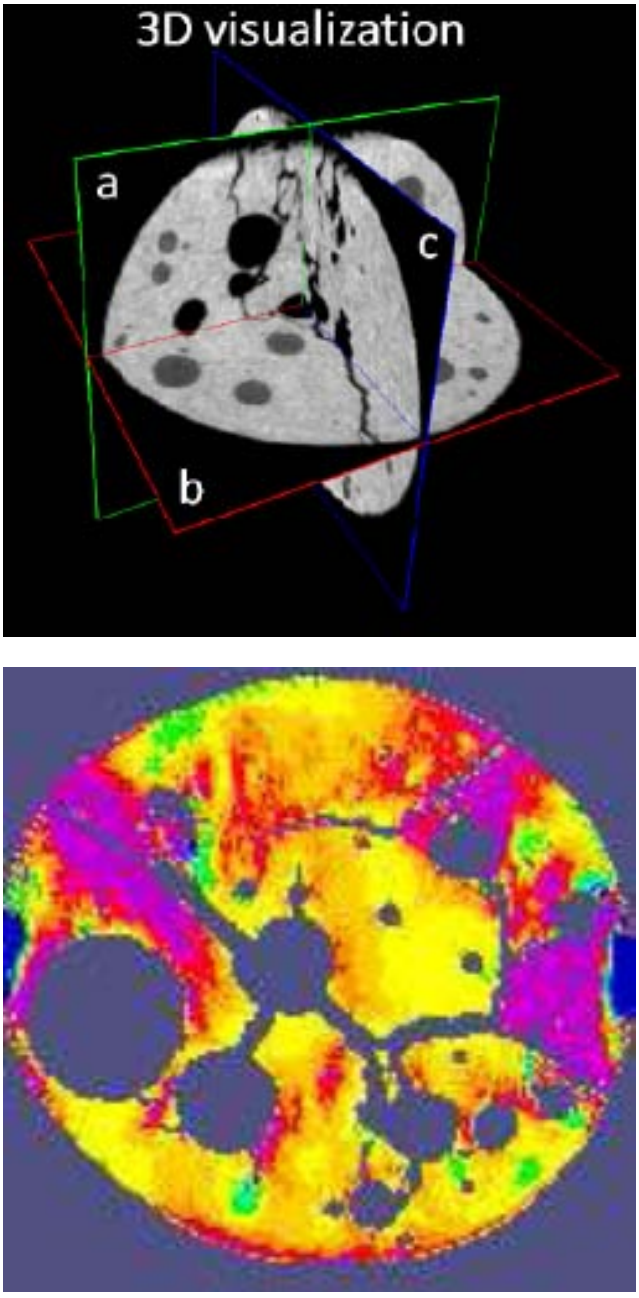


Figure 4. *Continuous CT-imaging of fracture test (WUT), and 3D micromechanics-based FE simulation of maximum principal stresses (TUW); ceramic biomaterial provided by Vladimir Komlev (INMATRIXS, Moscow).*

Christian Hellmich, WG3 Coordinator

NEWS FROM WG4: FUNCTIONAL MATERIALS

The working group consists of the following eight partners: FHG (IFAM, IFAM-DD), CIDETEC, IPM, POLITO, AITEX, CRF, AGH-UST and ITC. Collecting the specific interests and expertise from the partners the main fields of activities can now summarized as:

- materials and processes based on electrochemical techniques,
- functional polymers,
- biomaterials,
- materials for energy storage and energy conversion.

The development of functional materials is closely linked with the optimization and modification of production routes as well as joining technologies. A broad range of technologies are available in the KMM-VIN institutions.

Hydrogen storage in nanocrystalline metal hydrides is a long-term research topic in the research group "Hydrogen Technology" at IFAM Dresden. The improvement of storage capacity as well as the kinetics of absorption and desorption is under development. Nanostructured materials as well as catalysts play a key role in order to solve the problem.

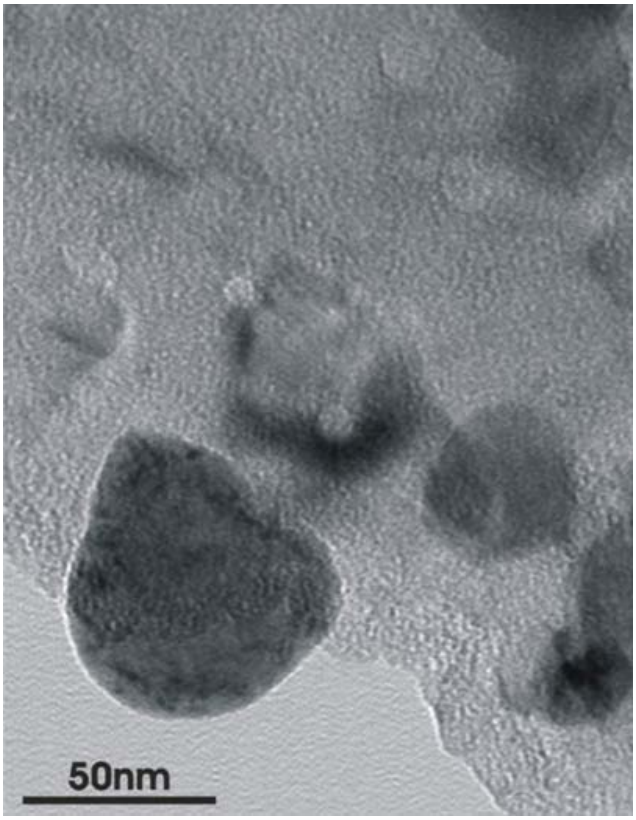


Figure 5. *TEM micrograph of hydrogenated melt-spun Mg-Ni-Y*

Two new projects started only recently. One project is dealing with hydrogen production based on alkaline water electrolysis where IFAM Dresden

develops new nanomaterials for electrodes in order to have a higher efficiency, long-term stability and reliability as well as cost efficiency by using cheap metals and alloys. The other is devoted to heat storage materials based on hydride-carbon composites. Here, IFAM Dresden succeeded at the 2010 presentation of the worldwide advertised E.ON Research Award in the field of "Heat Storage for Concentrating Solar Power (CSP)". Through the use of novel storage materials, solar thermal energy can be made available around the clock – also if the sun is not shining.

Thomas Weissgärber, WG4 Coordinator

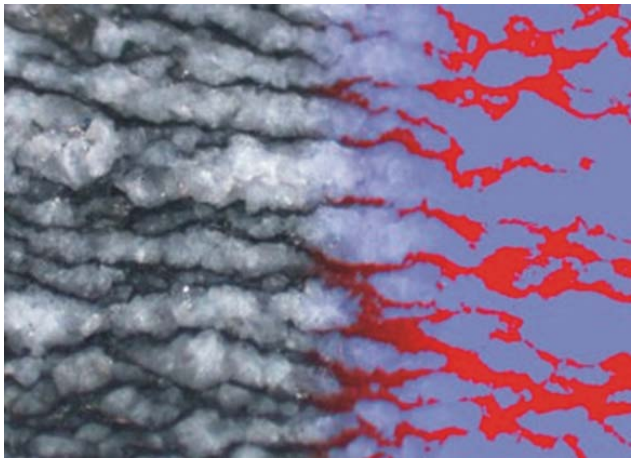


Figure 6. *Micrograph of a MgH2-ENG composite (blue-red) with optimized heat transfer properties*

KMM PROJECTS

During the past six months KMM-VIN has continued, as coordinator or partner, the execution of several FP7 projects: MATRANS, iNTeg-Risk, MUST, M-FUTURE2011. Most importantly, the INNVIN CSA proposal (FP7) submitted by KMM-VIN last February, which involves all KMM-VIN members who had expressed an interest to join the INNVIN consortium, was accepted by the EC and will start on 1 November 2011. Also, there is a number of successful proposals coordinated by KMM-VIN members and involving different groups of KMM-VIN members, without KMM-VIN being included in the consortia. To this end the following projects should be named: ISWA, JOLIE, NAMABIO, EMFforMET, GLACERCO, BIO-CT-EXPLOIT, HANCOC.

MATRANS (FP7)

"**Micro and Nanocrystalline Functionally Graded Materials for Transport Applications**" – project coordinated by KMM-VIN (M. Basista) started 1 Feb. 2010, duration 3 years. The consortium consists of 10 Beneficiaries and 6 third parties in the so-called KMM-VIN grouping (IPPT, IMIM, ITME, TUD, UNIVPM, POLITO – all KMM-VIN core members). Among the project Beneficiaries there are also 3 other KMM-VIN members: CRF, FHG (IFAM-DD) and R-TECH; project webpage: http://matrans.kmm-vin.eu.

Up to now MATRANS has been a project involving the largest number of KMM-VIN members of all projects reported in this column. It aims at development of novel metal-ceramic functionally graded materials (FGMs) for aerospace and automotive applications in: (i) exhaust and propulsion systems (thruster), (ii) power transmission systems (valve), (iii) braking systems (braking disc), with the main objective to enhance the mechanical properties of these materials through spatial variations of material composition and microstructure. Specifically, MATRANS deals with two groups of the graded bulk composites: FGM I (alumina ceramics-copper/copper alloys) and FGM II (alumina ceramics-intermetallics).

The project is organised in four research workpackages: Starting Materials, FGM Processing, Characterisation, and Modelling. For details of the results please consult the "Matrans Newsletter 2011" at the site Projects/Matrans/Public-documents of the www.kmm-vin.eu webpage.

The total EC funding of the project is 3.6 M€ with the KMM-VIN grouping's share of 2.38 M€ (coordinator + 9 KMM-VIN members)

iNTeg-Risk (FP7)

"Early Recognition, Monitoring and Integrated Management of Emerging New Technologies Related Risks." A large 4.5 year project started in December 2008, coordinated by KMM-VIN member - European Virtual Institute for Integrated Risk Management (A. Jovanovic). KMM-VIN grouping comprising itself and IPPT, IMRSAS, IMIM, MCL is a project partner. Further KMM-VIN members (MERL and R-TECH) are also involved in the project beyond KMM-VIN grouping. The total share of KMM-VIN grouping (4 members) in the EC funding is 185.5 k€; http://integrisk.eu-vri.eu.

MUST (FP7)

„**Multi Level Protection of Materials for Vehicles by Smart Nanocontainers**". Large cooperative project (2008-2012) coordinated by EADS Germany; consortium of 20 partners including a small KMM-VIN grouping (KMM-VIN itself and BioIRC). The KMM-VIN grouping (2 members) share in the EC funding of the project is 85.2 K€. BioIRC does the research work (numerical simulations) while KMM-VIN is involved in dissemination of the project results.

One agreed way of disseminating MUST results by KMM-VIN is publication of extended articles on MUST in the KMM-VIN Newsletters. In this Issue such an article is inserted in column "Cooperation". http://www.sintef.no/Projectweb/MUST.

M-FUTURE 2011 (FP7)
"**Materials & Manufacturing of the FUTURE**". A CSA project coordinated by Wroclaw University of Technology, started 1 Sep. 2010 for a duration of 1.5 years. It involves KMM-VIN core members IPPT and WUT as well as KMM-VIN itself.

The M-FUTURE project comprises two large European conferences as accompanying events of the Polish presidency of the EU:

- **FUMAT2011** ("Future Materials for Grand Challenges of our time"), 22-23 Sep. 2011, Warsaw, http://www.fumat2011.eu and
- MANUFUTURE 2011 ("West and East Europe in global High Added Value manufacturing -facts of today and challenges of tomorrow") 24-25 October 2011 (Wroclaw), http://www.manufuture2011.eu.

FUMAT2011 will comprise four Plenary Sessions and five Thematic Tracks: Materials for Future Energy; Materials for Transport and Environment; Materials in Health, Ageing Society and Bio-application; Materials for Sustainable Development; Societal dimension of advanced materials, Education, Trainings, Increase of awareness.

KMM-VIN is active in the International Advisory Committee of FUMAT2011 and in building up the programme of the conference, with direct involvement in Track 2: Materials for Transport. KMM-VIN CEO is among 12 invited speakers of T2.

KMM-VIN's share in FUMAT EC funding is 14 K€.

INNVIN (FP7) – ***new project***
"Innovative materials solutions for Transport, Energy and Biomedical sectors by strengthening integration and enhancing research dynamics of KMM-VIN".
Coordinator: KMM-VIN (M. Basista). The recently acquired CSA (FP7) project involving KMM-VIN and twenty one of KMM-VIN members. The rationale behind INNVIN is as follows: KMM-VIN has reached a considerable level of integration and organizational stability in some domains typically attributed to NoEs. While collaborative research and mobility programme are running reasonably well, the R&D services for industrial clients are not yet fully satisfactory.

The primary objective of INNVIN is to engage the large transnational partnership of KMM-VIN in the process of transforming it into an organization with increasing share of R&D contracts from industry, and to make them a contributing factor to KMM-VIN financial viability.

The strategy is to solicit contracts, testing, analysis, consultancy orders from industrial clients for the subconsortia of KMM-VIN members. The R&D offerings shall be problem-oriented comprising processing technology, characterisation of microstructure and properties, and modelling at design and in-service conditions.

KMM-VIN will primarily focus on Transport, Energy and Biomedical sectors as these are the ones where KMM-VIN's expertise has reached a critical mass.

A set of measures is proposed to reach these objectives: Survey of technology needs in Transport, Energy and Biomedical sectors, update of contents and enhancement of functionalities of KMM expertise and equipment database, promotion campaign of KMM-VIN research, service and education offerings, Recruitment of new KMM members from industry.

An important by-product of this strategic plan is to satisfy the economic criteria of an SME as this status can be beneficial for KMM-VIN financial stability.

EC funding for KMM-VIN consortium: 444.000 €.

BIO-CT-EXPLOIT (FP7)
"**Innovative simulation tool for bone and bone biomaterials based on enhanced CT-data exploitation**".
Project started 1 Dec. 2009. Coordinator: Vienna University of Technology (Ch. Hellmich), EC funding 900 K€. This project will enhance the competitiveness of four SMEs active in the markets of biomedical engineering and biomaterials design, through outsourcing of research activities to four RTD partners, including the KMM-VIN members: TUW, WUT and UNIVPM;
www.bio-ct-exploit.imws.tuwien.ac.at.

NAMABIO (COST Action)
"**From nano to macro biomaterials (design, processing, characterization, modelling) and applications to stem cells regenerative and dental medicine**".
The aim of NAMABIO is to coordinate research efforts of several actors belonging to different disciplines necessary in order to obtain a real breakthrough in the area of regenerative medicine of bones and teeth. The project is coordinated by UNIVPM (F. Rustichelli) and involves nine KMM-VIN members (UNIVPM, TUW, FRAUNHOFER-IFAM, FAU, AGH-UST, IMIM, WUT, BioIRC, UH). The project partners have expertise in processing of innovative biomaterials; chemical and physical and mechanical characterization; modelling of physical and mechanical properties; stem cell loading on biomaterials, implantation on animals, and histological and molecular evaluation; 3D structural characterisation of tissue engineered bones and teeth by X-ray synchrotron microtomography. The COST networking action will

include meetings, workshops, seminars, schools conferences and common publications. It started in April 2011 and will last 5 years.

JOLIE (MATERA+) "**Joining of Lightweight alloys to advanced FGM mEtal-ceramics materials**". A MATERA project coordinated by POLITO (M. Ferraris) and involving three KMM-VIN members (POLITO, CRF, EMPA). The aim of the project is to obtain a new car brake-disk system by joining one or more wear-resistant ceramic composite inserts to a lightweight alloy-bulk material to obtain lighter components and to improve energy efficiency. It started in June 2011 for a duration of two years.

GlaCERCo–ITN (FP7-People) **"Glass and Ceramic Composites for High Technology Applications – Initial Training Network".** Project coordinated by POLITO (M. Ferraris) started 1 February 2011, with 3.9 M€ funding during 4 years; www.glacerco.eu. Among the 10 partners 5 are members of KMM-VIN (POLITO, FAU, UNIPAD, IPM, MERL). The project offers a multidisciplinary training in the field of new high-tech glass based materials (glasses, glass-ceramics, glass- and glass-ceramic composites and fibres) with special attention to applications in strategic fields as medicine (bioactive glasses as bone replacement and drug delivery systems), telecommunications (glass devices for broad-band applications), photonics (glass based photonic sensors), clean energy (Solid Oxide Fuel Cells glass sealants),waste management (vitrification and re-use of wastes).

ISWA (FP7)
"Immersion in the Science Worlds through the Arts". A CSA project coordinated by UNIVPM (F. Rustichelli) started 1 March 2011. Among 16 participants from 15 countries are 4 KMM-VIN members: UNIVPM, IPPT, IMRSAS and TUW. The project is targeted at young people discovering the common characteristic of the creative process in arts and sciences. Examples of artistic events based on scientific issues will be realized by professionals from the following disciplines: Modern dance, Cinema, Imaging, Literature and will be displayed in several European cities.

EMFforMET (FP7-MC)
"Application of Electromagnetic Fields for Enhancement of Structural Metal Performance" – a Marie-Curie project for In-coming Fellowships submitted by A. Chrysanthou (UH) and A. Babutsky (IPSUA, former KMM-VIN core member). Duration 24 months, start date 1 July 2011.

KMM-VIN MEMBERS' NATIONAL PROJECTS

KomCerMet (Poland; EU Structural Funds)
"Metal-Ceramic Composites and Nocomposites for Aerospace and Automotive Industry". A Polish key project supported by the EU Structural Funds. Started 1st October 2008, duration 4 years. Coordinated by IPPT (M. Basista), consortium of 12 partners including 5 KMM-VIN members (IPPT, ITME, IMIM, WUT, AGH-UST). The total project budget is 6.3 M€, of which the KMM-VIN members' share is 4.4 M€; http://www.komcermet.ippt.gov.pl. More details in the "News from WG2" column.

FOTOCER (Spain; Ministry of Science & Innovation)
"**Development of photocatalytic surfaces using readily scalable techniques for use in industry**". Project aimed at photocatalytic surfaces (i.e. surfaces that react to the ultraviolet light) with long-lasting, self-cleaning and bactericide properties, started in October 2009 and will last until 2011. Six Spanish research centres are involved including ITC – coordinator and another KMM-VIN member – CIDETEC.

HANCOC (MNT-ERANet)
"**Hard NanoComposite Coatings**". The main aim of the project is the development and optimization of a novel technology of thin nanocrystalline, composite superhard coatings. In HANCOC participate two KMM-VIN core members: IMRSAS and AGH. Duration 3 years, coordinator J. Dusza (IMRSAS).

COOPERATION

European Technology Platform on Advanced Engineering Materials and Technologies (EuMaT). Since 2008 KMM-VIN has been providing the EuMaT Technology Platform with secretariat services and occasionally with meeting room facilities in KMM-VIN' office in Brussels. This has, in a natural way, promoted KMM-VIN in the industrial and research communities in Europe. By operating the EuMaT Secretariat KMM-VIN members have had the first hand and timely access to all kinds of materials-related information on the European level.

Also, the appearance of KMM-VIN name on the EuMaT website and on all EuMaT electronic correspondence has had a positive impact on KMM-VIN visibility among approximately 900 members of EuMaT ETP and in other organizations including the European Commission.

KMM-VIN members were actively involved in EuMaT WG4 (Knowledge-based Structural and Functional Materials) contribution to the updated Strategic Research Agenda, 2nd Edition, 2011 (see also "Personalia").

KMM-VIN cooperates closely with the EuMaT Steering Committee and EMRS in the preparations to the FUMAT2011 Conference, next September in Warsaw and in the horizontal initiative "Alliance for Materials" (A4M) put forward by EuMaT and five other Technological Platforms which have materials in their domain of interests.

Feature article

"Multi Level Protection of Materials for Vehicles by Smart Nanocontainers"

(introducing research activity of **MUST**[1] project)

The destructive effect of environment and the corrosion induced degradation are important factors which determine the economical service life of a vehicle or its components. The application of organic coatings is the most common and cost effective method of improving protection and durability of metal structures.

The long term performance of organic coatings is by nature subject to chemical and physical aging processes. One strategy to improve the in-service life of protective coatings is to respond to these events with healing reactions. This ability is expected to be most effective if it is reacting at certain stages of degradation with different healing processes. A significant improvement of the durability of protective coating is evident if early stage degradation phenomena are recovered and e.g. the decrease of the barrier properties of the coating is postponed to longer exposure times.

The ***main vision*** of the MUST project is to develop new active multi-level protective self-healing coatings and adhesives for future vehicle materials. These materials are based on "smart" release nanocontainers incorporated into the polymer matrix of current commercial products. A nanocontainer (or nanoreservoir) is a nanosized volume filled with an active substance confined in a porous core and/or a shell which prevents direct contact of the active agent with the adjacent environment.

The ***main objective*** of the MUST project is the design, development, upscaling and application of novel multi-level protection systems like coatings and adhesives for future vehicles and their components to improve radically the long-term performance of metallic substrates and structures. A **multi-level self-healing approach** combines - within one system - several damage prevention and reparation mechanisms, which will be activated depending on type and intensity of the environmental impact.

The ***main novel idea*** suggested in MUST is the multi-level protection approach based on functional nanocontainers. Several self-healing protection mechanisms were suggested before but were never combined together in the same polymer system. The innovative idea of this project is a gradually active protection response of the coating depending on the nature and the degree of impacts from external environment.

Figure 1 presents the multi-level self-healing concept that is based on gradual active feed-back of the protective systems to the environmental conditions. Different active components are incorporated at different levels into the smart protective system that will be able to respond to four different types and levels of impacts imposed to the coating:

- The first level of protection will be provided by the incorporation of nanotraps (nanoparticles able to absorb aggressive/corrosive species if their level in the coating or adhesive exceeds a critical value).
- The second level is based on the use of water displacing compounds, which are released from nanocontainers as soon as the first microdefects appear in the polymer matrix.
- Further growth of the defects will trigger the release of polymerizable precursors entrapped in other nanocapsules (third level of protection, see Fig. 1). Then a new thin polymer film will be formed, cover the damaged area and repair the layer, preventing crack propagation.
- The highest level of protection will be based on encapsulation of organic and inorganic corrosion inhibitors in different types of nanocontainers (10 – 100 nm in size) acting on demand and suppressing corrosion and delamination processes occurring in open defects or at cut edges.

[1] *See page 7 of this Newsletter for project details*

The MUST project is organized in three main chains starting with academic and research institutions, continuing through pigment and paint/adhesive producers towards transportation industry end users.

The industries directly involved in the production chain of materials for different transport sectors are represented in the project. The paint and adhesive producers play one of the key roles in the project since they will directly benefit from the obtained results.

The structure of the consortium is well balanced with partners from academic and research centres, industry (automotive, aerospace and maritime), SMEs and paint/adhesive suppliers from different European countries.

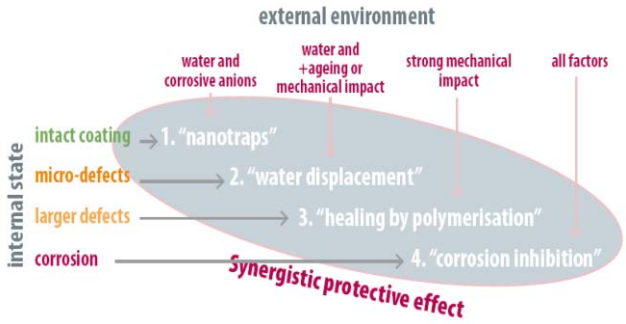


Figure 1. *Illustration of the multi-level protection approach.*

During three years of the project execution the consortium focused on developing novel self-healing protective coatings and adhesives. The first step in this process was creation of new nanocontainers with functional healing agents for different levels of protection. The activity of six partners was devoted to development of new nanocontainers using different approaches. Several promising solutions were suggested for all the protection levels.

The highest readiness level was achieved in the case of the 4th level nanocontainers loaded with corrosion inhibitors. Several approaches were used to immobilize inhibiting agents inside different nanocarriers. One of the possibilities is to use mesoporous oxide nanoparticles or hollow inorganic spheres. The nanocontainers composed of silica, titania, ceria, and cerium molybdate were developed. Figure 2 demonstrates one example of such mesoporous oxide nanoparticles developed within the MUST project.

Additionally, the surface of the nanoreservoirs can be functionalized with polyelectrolyte shells providing "smart" release of the inhibitor on demand under action of the pH-trigger. Other type of porous nanocontainers was developed using the same shells and natural halloysite clay nanotubes as a carrier.

Ion-exchange based triggering of the inhibitor release can also be used to control delivery of inhibiting species on demand. Layered Double Hydroxides (LDH) nanocontainers capable of providing an ion-exchange driven release were developed as well. This nanomaterial is composed of positively charged hydroxide layers with compensating anions in the intergallery space. The inhibitor species in anionic form can be used as compensations ions. The loosely bonded inhibiting anions from intergallery can be easily exchanged by the chloride ions present in the environment. Thus the nano-pigment is able to work as ion-exchanger storing the inhibiting ions and releasing them on demand only when aggressive chloride anions penetrate into the coating. Additionally, LDH can be used in the first level of protection as well since it is able to play role of a nanotrap of corrosive ions reducing aggressiveness of the corrosive environment.

The nanocontainers suitable for the 2nd and 3rd levels of protection can be created using the same encapsulation principals for different functional healing agents such as water displacing agents and monomers, respectively. The main approach here is to employ an oil-in-water micro-emulsion interfacial polymerization to provide micro-/nano-capsules of functional agents. Thus the opening mechanisms for different types of nanocontainers are as follows: local pH changing, ion-exchange, and mechanical rupture.

A remarkable achievement of the project is the up-scaling of production of the selected nanocontainers from the lab-scale (0.2 L batch) to a pilot-scale (30 L batch) keeping the same performance of the developed materials. In addition the up-scale to a pre-industrial-scale (200 L batch) is progressing well.

Another key issue in MUST is the fundamental investigation of the nanocontainers and self-healing processes. Since the topic of self-healing coatings is relatively new there is a lack of well-established experimental protocols for investigation of the self-healing effects. Therefore a lot of effort was invested by the MUST consortium in developing new experimental techniques or tuning the existing ones for the needs of the project. A set of complementary experimental methods was created allowing investigation of different self-healing mechanisms in the wide range of dimensional scale. The experimental protocols were created to study all four self-healing levels.

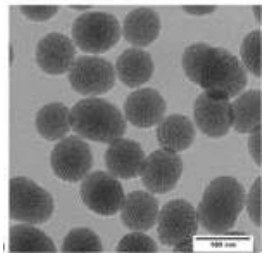
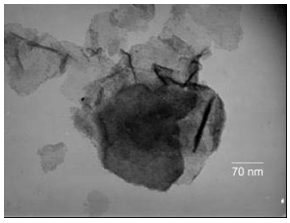
a)  b) 

Figure 2. *TEM micrographs of*
a) mesoporous silica nanoparticles and
b) LDH nanocontainers.

Scanning Kelvin Probe Method (SKP) was tuned to investigate the disbonding of the self-healing coatings from metallic surfaces under corrosive conditions. A scanning capillary cell in combination

with a stretching device enables measurement of the barrier properties on controlled formed samples. Focused ion beam (FIB) is a promising tool to create well-defined micro-defects in a controllable way. New protocols to study self-healing processes in micro-confined defects employing localised electrochemical techniques were suggested. Spatially resolved electrochemical techniques have the great advantage of giving local information, regarding evolution of the corrosion processes (progress and mitigation) on active defects of the coating.

The ability to inhibit corrosion activity in small defects created on the coating surface can be thoroughly investigated by SVET (scanning vibrating electrode technique) and SIET (scanning ion selective electrode technique).

One of the innovative approaches is the multilevel corrosion protection that must be provided by combining mixtures of containers loaded with corrosion inhibitors: This protection approach is based on encapsulation of organic and inorganic corrosion inhibitors in different types of nanocontainers acting on demand and suppressing corrosion.

Figure 3 presents a coating for the automotive industry that was modified with two types of containers devised for corrosion protection inhibition. A strong anodic activity on the defect formed on the reference sample can be seen (red spots in Fig. 3). However, very low activity is observed over the defect formed in the coating modified with mixtures of containers loaded with organic corrosion inhibitors. This indicates that nanocontainers answering to different stimuli and presenting different kinetics of release can be used simultaneously to provide corrosion protection on defect formed in the coating. This example illustrates the potential of the combined useof SVET & SIET effective assessment of the self healing ability.

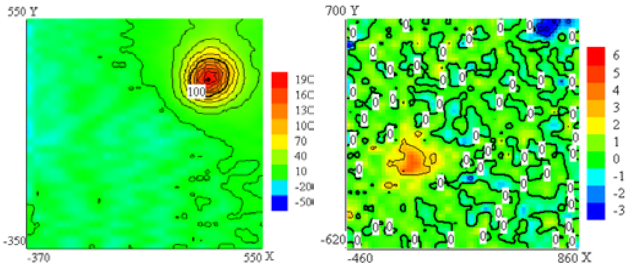


Figure 3. *Corrosion intensity maps obtained on a coating with a defect. Left: reference coating; right: Coating modified with containers filled with an organic corrosion inhibitor.*

The algorithm with computational code for the multilevel protection was developed as well. It accounts for the presence of water traps and containers with corrosion inhibitor in the multilayer coating, which can be released upon internal trigger (salt concentration, pH), and calculates transport of water and corrosive ions in the coating systems.

The most promising nanocontainers and nanotraps developed in MUST are now being introduced into different functional coatings and adhesives. In several cases a significant reduction of the corrosion-induced degradation processes can be observed. Figure 4 shows two examples where introduction of nanocontainers of corrosion inhibitor significantly delayed corrosive disbonding of adhesively joined steel surfaces. Introduction of nanotraps for corrosive species into automotive primer drastically decreased the formation of red rust during the accelerated corrosion tests (Fig. 5).

The best systems developed in frame of MUST project will be applied on the selected representative demonstrators and tested according the industrial standards. The results obtained so far in MUST are promising and demonstrate high chance of success of the project. Application of the new developed “smart” high-performance materials will sufficiently strengthen the competitiveness of the European transport industries, in particular the automotive industry.

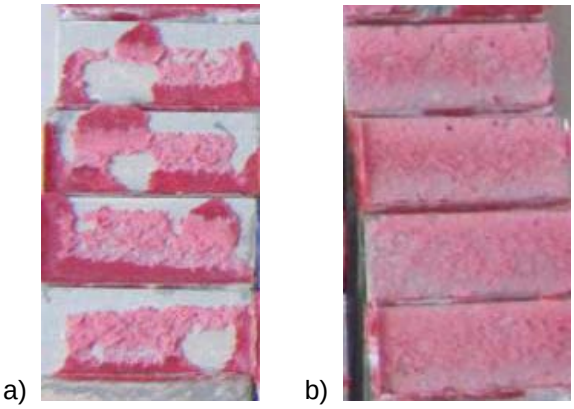


Figure 4. *a) Delamination behaviour of a model adhesive from galvanised steel surface after 20 VDA cycles.*
b) Delamination behaviour of a model adhesive loaded with nanocontainers at the same conditions.

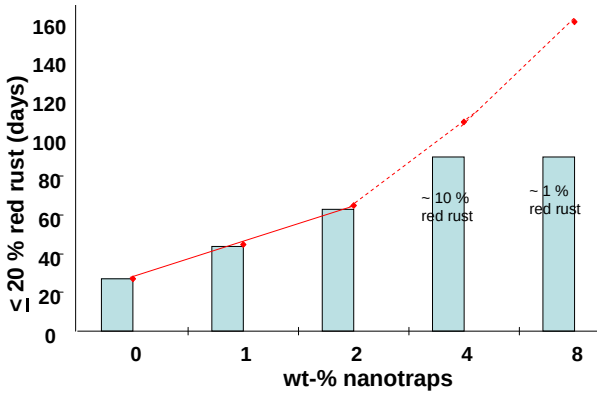


Figure 5. *Red rust appearance on galvanised steel coated with an automotive primer during SST.*

The MUST Management Team
Theo Hack, Mikhail Zheludkevich, Christian Simon

KMM-VIN RESEARCH FELLOWSHIPS, TRAININGS and RESEARCH POSITIONS

KMM-VIN Research Fellowships

The KMM Mobility Programme includes Research Fellowships intended for PhD-students and early stage researchers from the KMM-VIN member institutions (more info: www.kmm-vin.eu/LatestNews)

The 3rd call for Research Fellowships was closed on 31 March 2011. The submitted applications were reviewed by the Research Fellowship Committee consisting of the Chair of the KMM-VIN Mobility Programme (Josef Eberhardsteiner) and of the Coordinators of the KMM-VIN Working Groups (Andreas Chrysanthou, Aldo Boccaccini, Christian Hellmich and Thomas Weissgärber).

In this 3rd call, 5.5 person-months have been granted by KMM-VIN. In addition, four person-months were made available financed by POLITO. This additional grant is dedicated to Professors Margherita and Pietro Appendino.

Results of the 3rd Call of KMM-VIN Research Fellowships (2011)

Applicant (Institution)	**Host** (Institution)	**Stay** (months)	**Start** (date)
J. Hum* (FAU)	Ch. Hellmich (TUW)	2	01.10.11
W. Weglewski* (IPPT)	T. Weissgärber (IFAM-DD)	2	19.09.11
A. Yanakieva (IMBAS)	Z. Mroz (IPPT)	2	20.10.11
P. Indyka (IMIM)	E. García-Lecina (CIDETEC)	1	01.07.11
L. Hegedusova (IMRSAS)	A. Moreno (ITC)	2	05.07.11
M. Zietara (AGH-UST)	F. Rustichelli (UNIVPM)	0.5	01.09.11

** Margherita and Pietro Appendino Grant funded by POLITO*

Successful Marie Curie project "Application of Electromagnetic Fields for Enhancement of Structural Metal Performance" resulted with a 24 month in-coming fellowship for A. Babutsky from IPSUA, Kiev (former KMM-VIN member) at the University of Hertfordshire (A. Chrysanthou), starting on 1 July 2011.

Reactivation of KMM Summer Schools

A one-week KMM-VIN Advanced Course on "Skeletal tissue engineering mechanics, with links to biology, chemistry, and medicine", coordinated by Christian Hellmich (TUW) and Aldo Boccaccini (FAU) will be announced as a regular course at CISM (Udine, IT), 17-21 September 2012. This can be seen as a continuation of the KMM-NoE Summer Schools held each year at CISM from 2005 to 2008.

Research positions offered

MERL Ltd, Hitchin, Hertfordshire, UK offers Research Engineer Vacancy on "**Long Term Ageing of Composite Pipe**" in a Marie-Curie funded project. Two 18 month placements for students with no lower than a 2:1 Bachelor's degree. May be combined to be a three year placement for one student who can also study part-time for a PhD.

The project involves experimental characterization of new glass-fibre reinforced composites and numerical modelling of through thickness degradation.

Requirements: eligible to work in the UK and these from:
http://ftp.cordis.europa.eu/pub/fp7/docs/calls/people/m_gfamcitn_201001_en.pdf

Details and formal procedures:
http://www.glacerco.eu, glacerco.itn@polito.it.

Application to recruitment@merl-ltd.co.uk up to 1 July 2011 or later if no suitable candidate is identified.

CIDETEC, San Sebastian offers 3 post-doctoral positions:

1. "CIGS ELECTRODEPOSITION FOR PHOTO-VOLTAICS APPLICATIONS" in areas of electrodeposition and photovoltaics (chalcopyrite structures and its application to solar cells) for PhD holders in Chemistry, Physics, and/or Materials Science
2. "CERAMICS MATERIALS EXPERTS" in ceramic powder manufacturing (enamel, frit) and ceramic coating processing for PhD holders in Physics, Electrochemistry, Materials Science, Surface Engineering.

3. SURFACE FINISHING EXPERTS for PhD holders in Physics, Electrochemistry, Materials Science, Surface Engineering or similar. CV and, optionally, references should be sent to slarrocha@cidetec.es with the corresponding subject line. More details:
www.cidetec.es/noticias/03noticias_frameset.htm
("Send us your CV")

PERSONALIA

KMM-VIM members are active in organisation of meetings at the forthcoming **EUROMAT 2011** Congress that will be held in Montpellier, France, 12-15 September 2011:

- **Prof**. **Aldo R. Boccaccini (FAU)** is the coordinator of the topic Materials for Healthcare Applications, as well as co-organizer of the symposium Smart and biomimetic materials for biomedical applications and tissue engineering.
- **Dr Pasquale Vena (POLIMI)** and **Prof. Ch. Hellmich (TUW)** are organising the symposium: Mechanical characterization and modeling of tissues and biomedical materials at all length scales.
- **Dr Enrica Verne (POLITO)** organises the symposium on Bioactive Coatings and Material-Tissue Interfaces**.**
- **Prof. R. Filipek** (**AGH-UST**) and **Prof. N. Sobczak** (**IOD**) organize jointly a symposium on: Diffusion bonding and characterization within the topic "Joining".

Prof. Aldo R. Boccaccini (FAU) was or will be:

- co-organiser of the Symposium of the German Materials Society (DGM) on Composite Materials, Chemnitz (Germany), 30 March - 1 April 2011
- co-chair of the 3rd Syntactic and Composite Foams Conference held in Cetraro (Italy), 29 May – 3 June 2011.
- organiser of the Biomaterials Symposium at 9th Int. Meeting of Pacific Rim Ceramic Societies held in Cairns, Australia, 10-14 July 2011
- chairman of the 4th International Conference on Electrophoretic Deposition to be held in Puerto Vallarta, Mexico (2-7 October 2011) with the organisational support from CIDETEC. http://www.engconfintl.org/11ababstract.html
- co-organiser of the Professor K. K. Chawla Honorary Symposium on Fibers, Foams and Composites: Science and Engineering, to be held in the framework of the Materials Science & Technology 2011 conference (MS&T'11), Columbus, USA, 16-20 October 2011.

Dr Enrique Sánchez Vilches (ITC) organised a symposium on Silicates, Refractories, Cements, and Traditional Ceramics in the framework of the 13th Conference of the European Ceramic Society (ECerS) held in Stockholm, 19-23 June 2011.

Prof. Aldo R. Boccaccini (FAU) and **Prof. Ch. Hellmich** (TUW) were organisers of the "European Symposium on Biomaterials and Related Areas" (EuroBioMat 2011), held in Jena, Germany, 13-14 April 2011.

Prof. Christian Hellmich (TUW), formerly Associate Professor for Mechanics of Materials and Biomechanics, was appointed, on 1 April 2011, Full Professor for Strength of Materials and Computational Mechanics, in succession of Prof. Herbert Mang.

Dipl.-Ing. Jenny Vuong (**TUW**, PhD student under supervision of Prof. Christian Hellmich) was one of the finalists of the Y.C. Fung Biomechanics and Biophysics Student Paper Competition at the 2011 Conference of the Engineering Mechanics Institute – EMI 2011, Boston, MA, USA.

Prof. Franco Rustichelli had an invited lecture "Blood Vessel Visualisation by the innovative technique X-ray holotomography without any contrast agent". at the European Society for Artificial Organs (ESAO) Winter School in Semmering (26-29 January 2011).

EuMaT Strategic Research Agenda

Among the 30 contributors to EuMaT Strategic Research Agenda 2nd Edition (2011) 14 are our Colleagues from KMM-VIN, namely:

- Michal Basista (IPPT)
- Aldo R. Boccaccini (FAU)
- Andreas Chrysanthou (UH)
- Aleksandra Czyrska-Filemonowicz (AGH-UST)
- Pedro Egizabal (TECNALIA)
- Monica Ferraris (POLITO)
- Eva Garcia-Lecina (CIDETEC)
- Hans-Jürgen Grande (CIDETEC)
- Christian Hellmich (TUW)
- Philipp Imgrund (IFAM)
- Aleksandar Jovanovic (R-TECH)
- Tomasz Moskalewicz (AGH-UST)
- Enrica Verne (POLITO)
- Chiara Vitale-Brovarone (POLITO)

KMM-VIN Members
(Institutions)

CORE

1.	**AGH-UST**	AGH-University of Science and Technology, Cracow, Poland (*acronym changed*)
2.	**AITEX**	Textile Research Institute, Alcoy-Alicante, Spain
3.	**BioIRC**	Bioengineering Research and Developing Centre, Kragujevac**,** Serbia
4.	**CIDETEC**	Fundacion CIDETEC (Centre for Electrochemical Technologies), Donostia/San Sebastián, Spain
5.	**CISM Lab**	Centro Internazionale di Scienze Meccaniche Spin-off, Udine, Italy
6.	**CUT**	Cracow University of Technology, Poland
7.	**EMINATE**	eminate Ltd, Nottingham, UK
8.	**FGH**	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V:
	IFAM	Fraunhofer Institute for Manufacturing and Advanced Materials, Bremen, Germany
	IFAM-DD	Fraunhofer Institute for Manufacturing and Advanced Materials, Dresden, Germany
9.	**IOD**	Foundry Research Institute, Cracow, Poland
10.	**IMBAS**	Institute of Mechanics, Bulgarian Academy of Sciences, Sophia, Bulgaria
11.	**IMIM**	Institute of Metallurgy and Materials Science, Polish Academy of Sciences, Cracow, Poland
12.	**IMRSAS**	Institute of Materials Research, Slovak Academy of Sciences, Kosice, Slovakia
13.	**IMZ**	Institute for Ferrous Metallurgy, Gliwice**,** Poland
14.	**TECNALIA**	Fundación Tecnalia, Donostia-San Sebastian, Spain
15.	**IPPT**	Institute of Fundamental Technological Research, Polish Academy of Sciences, Warsaw, Poland
16.	**ITC**	Instituto de Tecnología Cerámica - AICE, Castellón, Spain
17.	**IPM**	Institute of Physics of Materials, Brno, Czech Republic
18.	**ITME**	Institute of Electronic Materials Technology, Warsaw, Poland
19.	**MCL**	Werkstoff-Kompetenzzentrum-Leoben Forschungsgesellschaft m.b.H. (Materials Centre Leoben), Austria
20.	**MERL**	Materials Engineering Research Laboratory Ltd, Hitchin, Hertfordshire, UK
21.	**ONERA**	Office National d'Etudes et de Recherches Aérospatiales, Chatillon, France
22.	**POLIMI**	Politecnico di Milano, Italy
23.	**POLITO**	Politecnico di Torino, Italy
24.	**R-TECH**	Steinbeis Advanced Risk Technologies GmbH, Stuttgart, Germany
25.	**TUD**	Technische Universität Darmstadt, Germany
26.	**TUW**	Technische Universität Wien, Austria
27.	**UH**	University of Hertfordshire, Hatfield, Herts, UK
28.	**UNIPAD**	Università degli Studi di Padova, Italy
29.	**UNIVPM**	Università Politecnica delle Marche, Ancona, Italy
30.	**WUT**	Warsaw University of Technology, Poland

ASSOCIATE

1.	**ALENIA**	Alenia Aeronautica S.P.A., Naples, Italy
2.	**CRF**	Centro Ricerche FIAT, Orbassano, Italy
3.	**EMPA**	Materials Science and Technology, Dübendorf, Switzerland
4.	**EU-VRi**	European Virtual Institute for Integrated Risk Management, Stuttgart, Germany
5.	**Saar-Uni**	Saarland University, Saarbrücken, Germany
6.	**FAU**	Friedrich-Alexander Universität Erlangen-Nürnberg, Germany (*acronym changed*)
7.	**VGTU**	Vilnius Gediminas Technical University, Lithuania

European Virtual Institute on Knowledge-based Multifunctional Materials (KMM-VIN AISBL)
rue du Trône 98, 1050 Brussels, Belgium
Phone: +32 2 213 4160, Fax: +32 2 791 5536, email: office@kmm-vin.eu
http://www.kmm-vin.eu

KMM-VIN Remote Office: c/o IPPT PAN, Pawińskiego 5 B, 02-106 Warsaw, Poland
Phone: +48 22 826 2522, Fax: +32 2 791 5536

Newsletter Editor: http://www.kmm-vin.eu/newsletter, Marek Janas, Marek.Janas@kmm-vin.eu