9th International Symposium on
9th German-Japanese Symposium on
nanostrucutures

Dear colleagues and dear All,

this is the 9th International | 9th German-Japanese Symposium on Nanostructures OZ-16. We are now meeting for the fifth time in Germany and still we are focussing on making things smaller and increasing function and benefit at the same time.
Making more with less will determine our all success in being able to satisfy increased demands of more people still with the same not-growing resources. An intelligent design of materials, processes and products also decides if we will be successful in changing our entire economies to fully recycle-able ones. There is no waste on this planet ! There is material !

Making more with less will determine our all success in being able to satisfy increased demands of more people still with the same not-growing resources. An intelligent design of materials, processes and products also decides if we will be successful in changing our entire economies to fully recycle-able ones. There is no waste on this planet ! There is material !

The nanoTruck has been with us in 2012 and 2014 but not any more since the German Federal Ministry of Education and Research BMBF unfortunately is not entertaining this very nice demonstration-vehicle any longer. The Official Photo of OZ-16 insofar will be taken outside on Rathausplatz in front of the Wenden townhouse - Monday 11:45 am.
Every year not a standard phrase but very much again we like to say “thank you very much !” to those, who made all this possible: our oral and poster speakers, our exhibitors and our attendees and last but not least at all, the diligent OZ-team and helping hands on site.
Let’s start another global brainstorming to the benefit of mankind and planet.

Domo arigatto, danke schoen and thank you very much.

Monte Cassim & Henning Zoz

RITSUMEIKAN

Zoz Group

OZ-symposia are organized by
Zoz Group & Ritsumeikan University
and in the past have been supported by the Ritsumeikan Global Innovation Research Organization (R-GIRO) Project and the Grant-in-Aid for Scientific Research on Innovative Area, "Bulk Nanostructured Metals", through MEXT, Japan.

The Ritsumeikan Global Innovation Research Organization (R-GIRO) project:
http://www.ritsumei.ac.jp/eng/html/research/

and the Grant-in-Aid for Scientific Research on Innovative Area, "Bulk Nanostructured Metals", through MEXT, Japan:
http://www.bnm.mtl.kyoto-u.ac.jp/

66 presentations from 17 countries
37 exhibitors from 10 countries

Austria, Belgium, Brazil, China, Czech Republic, Denmark, France, Germany, India, Israel, Italy, Japan, Korea, Mexico, Singapore, Switzerland, USA

[OZ-16]

9th International | 9th German-Japanese Symposium on Nanostructures

March 6-8, 2016
Wenden, Germany

unfortunately nanoTruck does not exist any longer

Address for the 9th International I 9th German-Japanese Symposium on Nanostructures, March 6-8, 2016 in Wenden, Germany

Nanotechnology is considered to be a key technology in the 21st century and is already well on its way to attaining economic importance. Only rarely has a development in the area of science and technology met with such overwhelming interest in such a short period of time, and this is certainly not least due to the outstanding cross-divisional function of nanotechnology in the fields of optics, medicine, transportation, chemistry, materals, information and communication technology, but also automotive and mechanical engineering. In terms of its broad impact, these “versatile dwarfs” even surpass the computer and its economic significance is correspondingly enormous.

Although there is general consensus that we are still only at the beginning of a promising development, nanotechnology already plays an important role when it comes realizing faster, higher performance and more intelligent products. In this respect, physical principles are being explored at the same time that marketable products are being offered, which best describes the fast pace of innovation in this field.

This innovative area also already has several points of contact for SCHOTT as a technology group. To be more specific, we have been working on nanostructures for decades. All of our glass-ceramics, from ZERODUR® to CERAN®, contain 30 to 80 nanometer crystallites that are responsible for their outstanding properties, “zero thermal expansion,” for example. Here, the fascinating material glass-ceramic is indispensable not only for cooktop panels but also for modern astronomy in the form of mirror substrates for telescopes.
We have also been manufacturing so-called striking glasses for some time. After heat treatment, targeted growth of nanoscale crystallites in binary semiconductor materials takes place in a special multicomponent glass. Their band structure, which also depends on their size, is responsible for the spectral properties of these extremely sharp-edged band filters.

Our CoralPor™ is one final example. When a borosilicate glass is subjected to a special thermal treatment, nanometer-sized segregated areas form within the material. By using a selective etching process, we are able to produce nanoscale porosity in the material that is ideal for use in nanofiltration and as a substrate in biochemical process technology.

These examples show that the “dwarfs” often operate behind the scenes and that immense research efforts make good sense and can be equally successful. This is why we welcome the exchange of the latest findings by experts from around the world. The Symposium on Nanostructures will also make an important contribution in this regard. I am already quite familiar with this event series that is now being held for the ninth time. After all, a few years ago, I used a scooter powered by a hydrogen drive with nanostructured solid matter storage to drive on stage to present an “Innovation Award.”

I wish all of the participants a good and successful event here in Wenden and as many new ideas and solutions as possible.

Dr. Frank Heinricht,
Chairman of the Board of Management of SCHOTT AG

SCHOTT
glass made of ideas

Address for the 9th International I 9th German-Japanese Symposium on Nanostructures, March 6-8, 2016 in Wenden, Germany

Nanotechnology is a future technology that will improve our lives. Nanotechnology enables the optimization and development of new products. With this, e.g. Health Products can be optimized or products in civil engineering can be made more durable. This makes Nanotechnology to a sustainable driving force in all areas of the economy and a growth driver. The wide application areas, such as energy technology, health research or environmental technology, prove the enormous potential of this technology.

For Germany as the leading technology and industrial nation, it is elementary to be at the top also in nanotechnology. Already today there is a highly innovative community of companies working on the development, application and marketing of nanotechnology products. Tens of thousands of jobs are associated. Insofar Germany has achieved a leading position in nanotechnology in Europe. As a part of our high-tech strategy, it is important to expand and promote potential and application in our various industries such as automotive, mechanical engineering and chemical industries. In this, particularly medium-size companies play an important role since already today they are the major driver in the development and application of nanotechnology.

I am pleased that you are coming together again at Wenden to share on your already ninth symposium to share and exchange latest findings and ongoing developments in nanotechnology. Only through a close international cooperation, the enormous potential of this future technology can be accessed efficiently. Germany and Japan in that are connected by a versatile economic interdependence and in common industrial policy interests. This symposium is a building block of this close relationship.

I wish you all a stimulating exchange and a good course of the event.

Thomas Bareiß, MdB
Representative for Energy Policy
of the CDU/CSU Parliamentary Group

CDU CSU Fraktion im Deutschen Bundestag

Address for the 9th International I 9th German-Japanese Symposium on Nanostructures, March 6-8, 2016 in Wenden, Germany

The Fourth Industrial Revolution will require Research & Innovation In Nanostructured Materials
Materials are the backbone in the manufacturing of industrial products, representing up to 20 % of the total product-cost. The fourth industrial revolution does count on the discovery & development of nanostructured materials in the future.

Innovation is the key of industrial welfare where e. g. within the Organization for Economic Co-operation and Development (OECD), innovation often is understood as a flux of investment money. For politicians, innovation is the creation of jobs. For an engineer it is not the improvement of but the creation of a new product which could not be foreseen and which finally will lead to new jobs and welfare. The driving force for innovation should not be politics but economics to motivate brains in a competitive world.

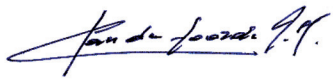
Europe's fundamental research and its inventiveness is world class, however our ability to transform new knowledge into new products is comparably inefficient described by the so-called 'Valley of Death'. Despite great efforts in the past decade, Europe's contribution of new high tech products to the world-market is less 20 %: a recent US newspaper described it as "Billions spent and nothing to show" !

Nanostructured materials are already walking into a great future and will be found in a very large number of applications offering new, sustainable properties in tomorrow's knowledge-based industry. Maintaining Europe's worldwide forerunner's position also in "nanostructures" does require great efforts in R&D & innovation from all regions throughout Europe and European institutions. Europe should have a unique model for research & innovation of new high-technology products like USA, China and Japan. The "fragmentation" in development policy of each country and its own financial structures should be disfavoured. And in order to generate a natural transfer of R&D findings from academia to start-ups and industry, a hybridisation of university and industry sectors including a new culture in both circles in Europe is required.

In companies and science-policy institutions, directors are generally and scientifically-technically very competent. In Europe, the leaders in industry often are from the financial sector with political nominations in European institutions resulting in strategies that are not always promoting innovation.

Also a new European educational culture (incl. mass media) where young people are attracted and motivated by science, (nano)technology & innovation, should be created. The "precautionary principles" of the political elite - with lack of international technology knowledge, hampering the concept of innovation e. g. by inappropriate regulations for new product developments do not fit into the future.

Insofar the Symposium on Nanostructures is since years focusing on the very right and very important goals and this as one of the very early cross-thinking and almost institutional-like event. I can only underline the motivation of staying to-date and maintaining the front position in nanostructured materials by frequent brain-exchange over different kind of scientific institutions AND industries can help to making this world a better and brighter one in the future. And I do wish all attendees very fruitful discussions and a successful 9th International



Prof. Dr. Marcel Van De Voorde
European Institutions
Science Council of the
French Senate & National Assembly

Address for the 9th International I 9th German-Japanese Symposium on Nanostructures, March 6-8, 2016 in Wenden, Germany

Nanostructures - a perspective for the future.

In the past several developments were drive to investigate the possibilities of nanomaterial. Nanomaterial is not just looking to the scale of 10-9 but leads to new material properties and new possibilities. One out of this is the possible increase of strength compared to “ordinary” material.

For me as a civil engineer and now the Director General of ESA, the European Space Agency those properties are of utmost importance: Space structures should be light because of the transport issue and should have a high strength because of various applications. One very special one is the dream of having a space elevator as described in the novel “Limit”, written by Frank Schätzing: The idea behind it is to build an elevator to the geo-stationary orbit where the orbiting time is identical to the rotation of the Earth. However “ordinary” materials do not allow the design of such a structure. More to the basis of day to day work all space structures should be as light as possible as the cost of transport are extremely high by using today’s launchers.

I therefore congratulate OZ for the intention to discuss on an international level nanostructures and their possible perspectives.

Prof. Dr. Johann D. Woerner,
Director General, European Space Agency

Schedule

time/day	Sunday, March 06, OZ-16 arrival-day		location
14:15-18:00	board meeting EUROGIA2020		ZTC
16:00-18:30	registration at conference site		expo-area
18:30-21:00	welcome reception & cultural program		

time/day	Monday, March 07, OZ-16 day 1	presentation	location
08:00-10:00	exhibition set-up, registration at the conference site		expo-area
10:00-11:30	welcome & concert	W01-05	auditorium
11:30-12:00	coffee-break, exhibition & posters - Official Photo of OZ-16	P01-Pxx	expo-area
12:00-12:45	session 01 (ceremonial lecture)	CL-D	auditorium
12:45-13:30	lunch, exhibition & posters	P01-Pxx	expo-area
13:30-14:45	session 02	V01-03	auditorium
14:45-16:00	session 03	V04-06	
16:00-16:30	coffee-break, exhibition & posters	P01-Pxx	expo-area
16:30-17:45	session 04	V07-09	auditorium
17:45-18:30	session 05	V10-11	
18:30-20:00	excursion 01		ZTC
18:30-20:00	coffee-break, exhibition & posters	P01-Pxx	expo-area
20:00-22:00	meet`n`greet party, cultural program, serendipity presentation	CL-W	audi&expo

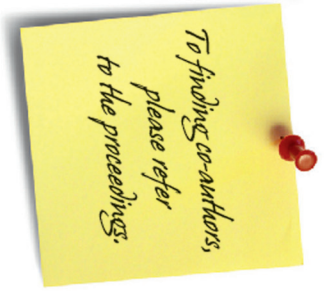
time/day	Tuesday, March 08, OZ-16 day 2	presentation	location
08:00-10:00	exhibition set-up, registration at the conference site		expo-area
10:00-11:30	session 06	V12-14	auditorium
11:30-12:00	coffee-break, exhibition & posters	P01-Pxx	expo-area
12:00-12:45	session 07 (ceremonial lecture)	CL-J	auditorium
12:45-13:30	lunch, exhibition & posters	P01-Pxx	expo-area
13:30-14:45	session 08	V15-17	auditorium
14:45-16:00	session 09	V18-20	
16:00-16:30	coffee-break, exhibition & posters	P01-Pxx	expo-area
16:30-17:45	session 10	V21-23	auditorium
17:45-18:30	sessions 11	V24-25	
18:30-20:00	excursion 02		ZCS
18:30-20:00	coffee-break, exhibition & posters	P01-Pxx	expo-area
20:00-21:00	reception at ZCS		ZCS
19:00-21:00	exhibition turn-down		expo-area

[OZ-16 post conference days]

FuturZement|Beton & more | large scale demonstrations

Wednesday & Thursday

please see schedule at the end of this conference guide



8th International | 8th German-Japanese

Symposium on nanostructures

Presentations

auditorium

Session Chairpersons to OZ-16

Session Welcome & 01

Airbus Group, Ottobrunn **Corporate Technical Office**	Dr. Detlef Müller-Wiesner Senior Vice President, Senior Technical Advisor

Session 02 & 03

EUREKA-eurogia^{2020} **Brussels**	Gabriel Marquette General Manager

Session 04 & 05

Helmholtz-Zentrum Geesthacht **Materials Technology Division**	Prof. Dr. Thomas Klassen Director

Session 06 & 07

Airbus Defence & Space **Friedrichshafen**	M.Sc. Alina Zoz Aerospace Engineer

Session 08 & 09

Airbus Group, Hamburg **Airbus CoC Systems**	Dr. Barnaby Law Senior Manager, Head of Integrated Fuel Cell

Session 10 & 11

Rusnano, Moscow **Board of Directors**	Prof. Dr. Sergey Kalyuzhnyi Director, Chief Scientist






AIRBUS GROUP	EUREKA innovation across borders	Helmholtz-Zentrum Geesthacht Zentrum für Material- und Küstenforschung	AIRBUS DEFENCE & SPACE	AIRBUS	RUSNANO
W01+S01	S02+S03	S04+S05	S06+S07	S08+S09	S10+S11

Welcome Session | 12:00 - 12:45

W01 **[Welcome to OZ-16]**

City of Wenden
Germany

Bernd Clemens
Mayor

Ritsumeikan University
Japan

Prof. Dr. Monte Cassim
Vice Chancellor

Zoz Group

Prof. Dr. Henning Zoz

W02 **[Welcome to Germany]**

Economic Ministry NRW
Düsseldorf, Germany

Garrelt Duin
State Economic Minister

W03 **[Welcome to Technology]**

European Space Agency
Paris in Europe

Prof. Dr. Johann D. Woerner
Director General

W04 **[Welcome to Europe]**

European Academy of Sciences and Arts
Salzburg in Europe

Prof. Dr. Felix Unger

President

W05 **[Welcome from China]**

MOHURD - Ministry of Housing & Urban-Rural Development
Beijing in China

Mr. Xiao-Fan Xie

Executive Vice President
China Municipal Engineering Association (CMEA)

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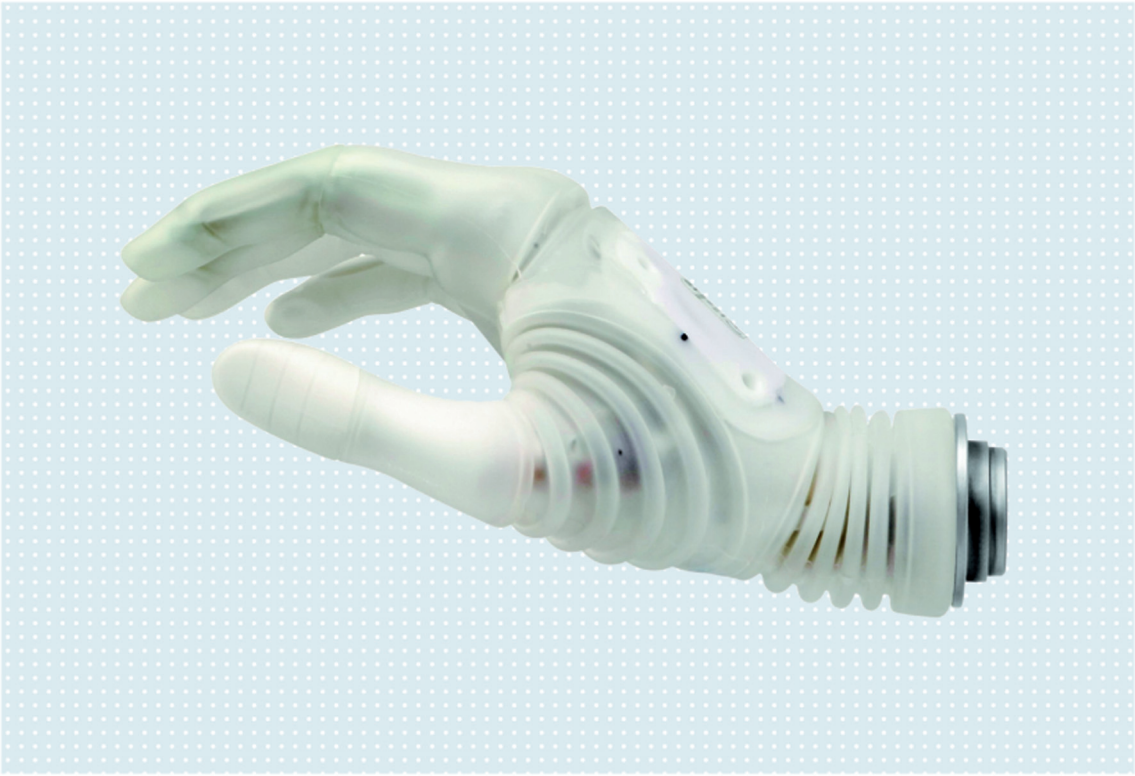


Michelangelo Hand

- Natural appearance
- Unique functionality
- Extraordinary design

Michelangelo Hand is made from a combination of soft and hard materials and is based on the natural hand, down to the finest details.

Quality for life

Otto Bock Group
Germany/Austria

Dipl.-Ing. Dr. Hans Dietl
Chief Technology Officer (CTO)

Man Machine Interface in Rehabilitation of Human Movement - Technological Challenges

Prostheses that replace limbs are typically categorized in lower and upper limb prosthetics. Great advances have been made for lower limb loss. State-of-the-art lower limb prostheses mimic natural gait more closely than ever before. Amputees can walk intuitively with changing speed and without risking stability. In contrast to lower limb prosthetics, the progress in upper limb prosthetics has been moderate for decades. Only recently new commercial developments have become clinically available. This new generation of devices offers better functionality and new compliant components by improved mechatronic designs which utilize advances in materials, rechargeable batteries, and actuators. Compared to human limbs, however, the performance of these new prosthetic components is still very limited. Further progress is hampered by the limitations in the man-machine interfaces that control these devices. Their signal processing and control mechanisms, which are usually based on myoelectric activity, are still very simple and similar to conventional systems. Also, prosthetic users still have to rely solely on visual feedback, since current prosthetic systems do not provide any explicit somatosensory feedback of haptic or proprioceptive information. Consequently, the information transfer rates are very limited and the control of a larger number of degrees of freedom is cumbersome and slow. Academic research has suggested various ways to overcome these problems and significantly improve the man-machine interface. The possible solutions include shared control approaches, closed loop control, advanced signal processing, selective nerve transfer, and new non-invasive and invasive signal acquisition methods. Different approaches which are already in clinical use as well as future concepts for interfacing to the human body, for control purposes as well as for load transfer and distribution will be discussed.

ottobock.

V01 **Heraeus Performance Products**
Magnetic Data Storage Division
Singapore, Republic of Singapore

Dr. Pavan Suri
Director of Research and Development

Mechanical Milling and Terabytes

The humble hard disk drive, a popular and highly cost effect storage medium is an engineering marvel. The data is stored as bits on magnetic material with each bit typical consisting of 6 to 8 'magnetic' grains - each with an average diameter of 6 nanometers. Magnetic grains are deposited via magnetron sputtering using targets that contain alloys of precious metals combined with oxides in the range of 30 to 40 volume percent of oxides. The oxides containing metal matrix composite is produced via mechanical milling followed by consolidation of the milled powders. In this presentation, impact of the milling process on the properties of the targets and downstream impacts on the magnetic layers deposited via sputtering are discussed briefly.

V02 **Oak Ridge National Laboratory - ORNL**
Materials Science & Technology Div.
Oak Ridge, TN, USA

Dr. David T. Hoelzer
Senior Research Scientist

Overview on the Development of Nanostructured Ferritic Alloys for Advanced Fuel Clad Applications in Nuclear Reactors

Designing advanced alloys that possess attractive high-temperature deformation behavior, such as strength, creep resistance and failure characteristics, and tolerance to extreme irradiation environments of advanced nuclear energy reactors presents a grand challenge. A new generation of advanced oxide dispersion strengthened (ODS) ferritic alloys, such as the 14YWT nanostructured ferritic alloy (NFA), offer great potential in achieving many of these challenges. Development of 14YWT, and more recently the FCRD-NFA1, during the past 15 years has led to considerable insight into processing (via mechanical alloying)-mechanical properties-microstructure relations and more recently into the influence of O, C and N concentration levels on the mechanical properties and the response of the mechanical properties and the microstructure consisting of ultra-fine grains and high concentration of 2-5 nm size Ti-, Y- and O-enriched nanoclusters to ion and neutron irradiation at various temperatures. In recent years, the DOE Fuel Cycle Research and Development program has shifted focus on developing fabrication methods for producing thin wall fuel clad tubing and solid-state joining methods, such as friction stir welding, for the NFA alloys. This presentation will address both the historical and recent progress in development of 14YWT and FCRD-NFA1 and cover topics on the current understanding of the influence of high-dose irradiation, clad tube fabrication and solid-state joining on the microstructure and mechanical properties of these advanced alloys.

V03 **Advanced Research Centre (ARCI)**
Centre for Nanomaterials
Hyderabad, India

Dr. Ravula Vijay
Scientist 'F' and Team Leader

Development of Nanostructured Materials using Simoloyer Technology at Zoz-ARCI Center

The rapid growth of living standards as well as the increase in world population creates more and more demand on performance of materials. It is well known that nanostructured materials improve the properties of the component thereby increasing the efficiency. ARCI has been working on development of nanomaterials by various techniques like flame spray pyrolysis, RF induction plasma atomisation, sol-gel process and high energy milling. A Zoz-ARCI Centre was established at ARCI, Hyderabad for demonstration of Simoloyer Technology (high energy horizontal ball mill) in India. Simoloyer technology is being used to develop various materials like Aluminium flakes, Oxide dispersions strengthened (ODS) steels, Al alloy-CNT composites, Zinc Oxide Varistors. This paper presents the efforts being made by ARCI and salient features of these materials.

V04

Airbus Group Innovations
Airbus Defence and Space GmbH
Ottobrunn, Germany

Dr. Blanka Lenczowski
Senior Expert
Material Technology

New product vision for Aerospace by applying of new lightweight aluminum technologies

The criteria for material selection for aerospace application have evolved over the years. In this century the key characteristics of successful aerospace products are driven by customer value and minimal environmental impact. In the neck-and-neck race from aluminium alloys and polymer based composite seems there is a big chance for aluminium based material to take over the leading position in the future aerospace products again. The statement is an introduction of new design concepts with appropriate alloys and material technology, that supports the new approach of "care free" structure designed for minimum life cycle cost. Today a combination of low weight, good damage tolerance, reliability, maintainability, low manufacturing cost, recyclability are needed to satisfy the required operating cost and safety of the aircraft. A reduction in weight together with improving resistance to corrosion decisively influence the direct operating costs of fixed-route services for airlines and hence the cost effectiveness. Under pressure from competing CFRP (Carbon Fiber Reinforced Plastic) for structural application Al-Li based alloys and Al-Mg-Sc technologies are a new trust for the aluminium industry. A revolutionary utilization of aluminium-based technologies paves the design of lighter, greener aircrafts by ensuring the highest level of reliability.
The key criteria for successful material development based on a/the patent portfolio from AGI regarding the success story on Al-Mg-Sc and Al-Li alloys technology for aerospace application have to be presented here.

V05

RIKEN
(The Institute of Physical and Chemical Research)
Materials Fabrication Laboratory
Saitama, Japan

Prof. Dr. Hitoshi Ohmori
Director, Chief Scientist

Nano-precision Grinding with ELID (Electrolytic In-process Dressing) and Nano-diamond

Nano-diamond has been attempted to be applied to surface finishing on loose and fixed abrasive processing. Especially, fixed abrasive processing with nano-diamond particles and ELID (Electrolytic In-process Dressing) has been invented and has produced superior mirror surfaces at a nanometric surface precision for electronic, optical, and highly functional materials. Conductive bonding materials are used to fix nano-diamond particles, and ELID can refresh the grinding tool surface by means to dissolution of its bond. And thus, the grinding tool surface can remain to protrude nano-diamond for finishing. 0.3nm in Ra roughness parameter could be achieved by this method. In addition, nano-diamond has been applied as filler of bond for grinding tool containing #2000-#8000 diamond for abrasives. Nano-diamond has average diameter of about 5nm, on the other hand, #2000-#8000 diamond have about 6-1.5 microns in their average diameter. Grinding tools have been developed by using #2000 and nano-diamond with its concentration of 12.5-25 and 0.4-4 vol % respectively, and could produce about 3nm in Ra for hard and brittle materials such as glass and sapphire.

V06

IME - Fraunhofer-Institute for Molecular Biology & Applied Ecology
WWU -
Westphalian Wilhelms-University Muenster
Münster, Germany

Prof. Dr. Dirk Prüfer
Head of Plant Biopolymers
& Vice Dean

Forisomes as smart biomaterial in microscale and nanoscale devices

There is increasing interest in mechanically-active polymers as these may form the basis of smart materials that could serve as actuators in microscale and nanoscale devices. ATP-driven motor proteins have great potential in this context, but their activity often depends on a strictly defined biochemical environment, which restricts their application. Natural proteins that deform reversibly through entropic mechanisms might serve as useful models for artificial contractile polypeptides, and forisomes, the protein bodies from sieve elements in higher plants provide a novel example. These form a microfluidic system that controls the pressure-driven transport of photoassimilates throughout the plant. Unique protein bodies in the sieve elements of legumes act as cellular stopcocks, by undergoing a reversible, Ca2+-dependent conformational switch. In living cells, this reaction is probably controlled by Ca2+-transporters in the cell membrane. We have shown that forisomes undergo an anisotropic and ATP-independent conformational change, which is easily reversible in vivo and in vitro. Thus far, we have cloned all the genes encoding forisome components and have recently produced the first recombinant forisomes in yeast. Recent developments in the design of smart materials based on recombinant forisomes will be presented.

V07 **Schaeffler Technologies AG & Co. KG***
Competence Center Surface Technology
Herzogenaurach, Germany

Dr. Yashar Musayev
Senior Vice President
Surface Technology

Nanostructured Coatings as Key Design Element for the Mobility for Tomorrow

The focus areas of future mobility are environmental drives, urban and interurban mobility and the corresponding energy chain. Environmental drives are one of the major factors that determine energy efficiency and environmental compatibility of mobility. The surface properties of engine components must be adjusted to more stringent environmental requirements while friction losses can be minimized by modern surface technology for improved fuel efficiency and reduced CO2-emissions. The surface properties must be therefore adjusted to the growing environmental requirements. This includes measures for corrosion, functional friction and wear protection, for optimum electrical or thermal conductivity and for optical purposes. For all cases nanotechnology contributes significantly to the development and improvement of coated Schaeffler products in mass production by using the new special properties of nano coatings. E. g. the Triondur® DLC coated engine components in mass production have been realized (about 100 million pieces/year) by Schaeffler. The potential of such coatings in rolling contact bearing components has also already been established in the serial production. In terms of new topics for Schaeffler like the Fuel Cell ("Mobility for tomorrow") nanostructured coating systems will also play a fundamental role.

(shortened - pls. see proceedings)

V08 **Montan-University Leoben**
Erich Schmid Institute of
Materials Science - ESI
Leoben, Austria

Prof. Dr. Jürgen Eckert
Director of ESI

Powder Metallurgy of Advanced Materials

Among different processing routes, powder metallurgy has a large potential for development of novel high-performance materials thanks to excellent control over phase and microstructure selection, and related physical and mechanical properties. This overview describes methods and process variables employed for synthesis of advanced materials. These methods include mechanical attrition for the production of metastable materials, powder consolidation to create bulk specimens with the desired microstructure and properties, and additive manufacturing for fabrication of parts with intricate and complex geometries. Experimental data for the resulting structures obtained by powder metallurgy of single- and multi-phase materials will be described for selected materials, including nanostructured phases, quasicrystals, composites and metallic glasses, and the mechanisms responsible for phase and microstructure formation and the related properties will be discussed. Consideration of the problems and challenges for powder processing will also be addressed.

V09 **NOW GmbH**
National Organization Hydrogen
and Fuel Cell Technology
Berlin, Germany

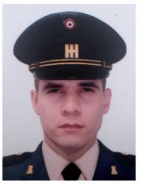
Dr. Klaus Bonhoff
Managing Director

Hydrogen: key technologies for a sustainable energy system

Germany is shifting its energy systems from reliance on fossil fuels to supply regimes based on renewable energies. Both nationally and internationally hydrogen receives growing recognition as a transport fuel and medium for energy storage. Hydrogen produced from renewable energies and used as a fuel promises substantial cuts in green house and other emissions, and reduces dependency from imports of fossil fuels. Especially where low or zero emission performance is required for bigger and larger-range vehicles, many stakeholders bet on fuel cell electric vehicles.

V10 **Escuela Militar de Ingenieros - EMI**
Mexico D. F., Mexico

Capt.
Orlando Gutiérrez Obeso
Head of Research Military
Engineering School



Composite concrete wall panels for shielding military buildings

The issues of human and/or building security have always been of great interest for military applications worldwide. Valuable technical information derived from the practical experience on security and safeguarding recently developed by the Mexican Army, focusing building and ballistic guard (constructive-shield) is briefly introduced in this talk, following the next order:
(a) The mechanical behavior of traditional building materials when impacted with a firearm and how these materials lack the necessary elements as to provide ballistic protection in case of attack.
(b) A descriptive presentation is given on various mechanical properties of building materials to be impacted by a firearm. From a mechanical viewpoint the speaker will focus on the resilience concept of composite concrete wall panels, and will discuss how it influences the optimal performance design of the concrete shield when exposed to the heavy weapons attack.
The performance of cost effective composite concrete wall panels for shielding military buildings is introduced in this talk. Keywords: ballistic impact, projectile´s impact, constructive-shield, ballistic protection, construction, Mexican army, security, high performance cement.

V11 **Continental Reifen Deutschland GmbH**
Hannover, Germany

Dr. Carla Recker
Head of Expertfield
Materials Chemistry

Sustainable Tire Materials

Vehicle tires are a product which is older than 100 years, nevertheless, new material developments are a key driver to continuously improve their performance. To evaluate the sustainability potential of tire raw materials, a huge variety of aspects have to be considered. Based on these, various strategies to develop new approaches could be derived. Even for materials like natural rubber, which is already seen as 'green' tire raw material, alternative sources must be established to meet future demands. The complexity of introducing new sustainable value chains will be discussed using Russian Dandelion as an example.

Technical Excursion No.1 heading to ZTC

Zoz Technology Center

Raiffeisenstrasse 17 | D-57462 Olpe

| reasonable commercial space at convenient location

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Helmholtz-Zentrum Geesthacht
Geesthacht, Germany

Prof. Dr. Wolfgang Kaysser
Director

Innovations by Scientific Surprises and Long-term Development

What role does chance play in the development of innovations? Some important discoveries in the field of materials research suggest that chance plays a key role in major breakthroughs.
A closer look at some historical examples illustrates that most often a combination of systematic research and chance leads to success.
Current examples confirm that this combination of chance and long-term development still gives rise to progresses in materials development today and in the future.
Based on the scheme of "growth of knowledge" and changing ancillary conditions some pioneering developments in the field of materials science and materials technology will be discussed.

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

V12 **MATSYS Inc.**
Sterling, VA, USA

Dr. Tony Zarhah
President

Consolidation of Nanostructured Powders into Bulk Nanostructured Materials

The use of metal particles with nano-particle size will help to increase the mechanical properties of the bulk material. However, nano-powders are expensive and not always available. An alternative approach is to use high energy milling as a means to refine the microstructure of the micron size powder and greatly reduce the grain size. A critical step in the fabrication of bulk materials with fine-grained microstructure is the design of a powder compaction process to produce fully dense material while preserving the microstructure of the starting powder. While many forming techniques exist, nano-grained metal powders require special processing. The objective is to identify the temperature-pressure-time regime to reach full densification while minimizing grain growth. MATSYS has developed unique sensor technology for Hot Isostatic Pressing (HIP) that can be used to efficiently and cost-effectively develop the processing schedules for consolidation of powders into bulk nanostructured materials.
An alternative to HIP is microwave sintering. Microwave technology is a nonconventional electromagnetic field assisted processing technology that is emerging as having the potential for meeting the goals of "better, faster, cheaper, and greener" technology for the sintering of a variety of materials.

(shortened - pls. see proceedings)

V13 **EMPA - Swiss National Institution for Materials Sciences and Technology**
EPFL - Ecole Polytechnique Fédérale de Lausanne
Dübendorf & Lausanne, Switzerland

Prof. Dr. Andreas Züttel
Head of "Hydrogen & Energy"
Director of Laboratory of Materials for Renewable Energy (LMER)

Industrial scale solid state hydrogen storage - recent advancements and applications

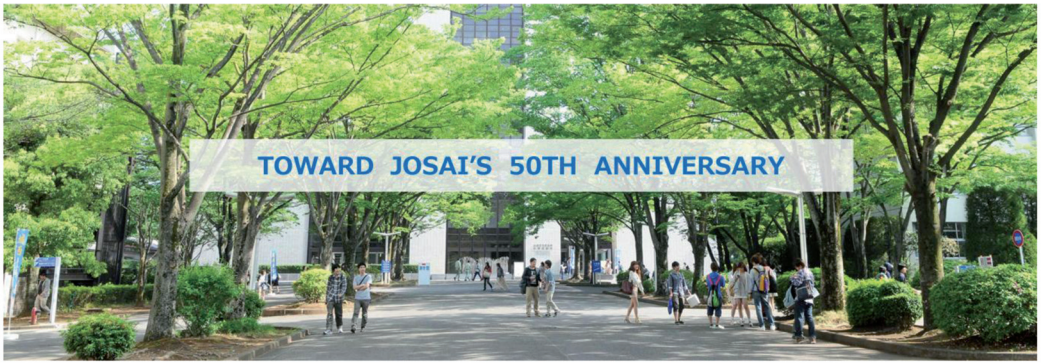
Nanostructures exhibit a large specific surface area which determines the maximum amount of hydrogen adsorbed by Van der Waals interaction. Furthermore, the shape of the surface and the composition defines the interaction energy, therefore, hollow structures are especially interesting for the search of new materials with an increased physisorption energy. On the other hand, nano structuring of hydrides changes their stability and allows to stabilize hydrides which tend to spontaneously release hydrogen at room temperature. The size effect as well as the interaction between a hydride and the wall in a nonporous material lead to a change in the thermodynamics as well as the kinetics of the hydrogen sorption process. Hydrides which are irreversible in the hydrogen sorption because of the multiphase products after desorption become reversible when the products are kept in place close to each other on the atomic scale. Last but not least the high catalytic activity of nano size metal clusters combined with the steric limitations open new ways of controlling reaction pathways and the synthesis of specific products. This is especially important for the storage of hydrogen by the reduction of CO2 to liquid synthetic hydrocarbons. Foe this reaction a high chain growth probability is requested but at the same time the length of the hydrocarbons has to be limited.

V14 **IPA -**
Fraunhofer-Institute for Manufacturing Engineering & Automation
Department for Functional Materials
Stuttgart, Germany

Dipl.-Ing. Ivica Kolaric
Department Manager

Nano-precision Grinding with ELID (Electrolytic In-process Dressing) and Nano-diamond

With the need to ensure complete traceability of every part of automobiles and machines from production until end of life there is a need for cost efficient printable layers that can be used as communication nodes. Recent developments show a trend for products, which are completely energy autarkic during their lifetime. Such intelligent tags will be used first in industrial machinery as part of the internal communication between the different parts of the production line for implementation of Industry 4.0 functionalities. The state of the art materials, especially metals are price sensitive and not infinitely available. Most promising candidates are electrical conductive nanocarbon materials like CVD graphene, graphene flakes, nanotubes or nanowires and their hybrids. The main interest of Fraunhofer IPA is to develop processes for synthesis, purification, coating, patterning and printing of these nanomaterials. These cyber physical systems consist of energy harvesting modules, energy storage modules and antennas.
The presentation gives an overview of research and development activities of Fraunhofer IPA in the field of production technology in the area of Production Technologies with main focus on graphene.



Josai University was founded in 1965 when the postwar recovery was well underway and demands were raised for a new role for Japan in the international community. The university has already turned out more than 90,000 outstanding graduates by leveraging the philosophy of its founder for a place of education and research, and aspiring to educate students active in the international community by promoting international education programs designed to cultivate the human qualities, outlook, knowledge and skills necessary to demonstrate leadership in the international community.

The university has earned a strong reputation as a training ground for civil servants and teachers, and we are proud of our stable graduate employment rates even in the current bleak economic climate and employment outlook. As far as employment is concerned, substantial support structures and a focus on education, sports and human education to cultivate trustworthy working adults have brought results.

As an international university with close contacts to the local community, Josai University collaborates with local government, corporations and many overseas sister universities to educate students who are capable of acting on the global stage, as well as human resources who can contribute to community development.

Josai University Educational Corporation

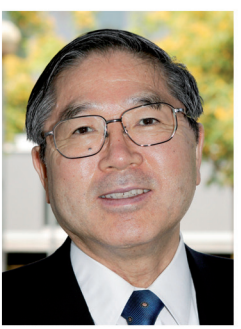
Josai University

Josai University
Tokyo, Japan

Prof. Dr. Akihisa Inoue
Director

Bulk Metallic Glasses; Development, Applications and Future Prospect

Since the findings of multicomponent glassy alloys with distinct glass transition and wide supercooled liquid region before crystallization in 1988, followed by the first synthesis of La-based bulk metallic glasses by copper mold casting in 1990, much attention has been devoted to the syntheses if new bulk metallic glasses, the clarification of fundamental and engineering properties, the searches for new phenomena and the findings for new application fields, in conjunction with the developments of net shape casting and undercooled liquid forming processes. The great attention and curiosity for a number of researchers are due to the novelty, strangeness and usefulness of the new metallic bulk glasses which were created after a long time in the long history of metallic materials. To be concrete, the extremely high stability of undercooled liquid against crystallization for multicomponent alloys with the special component rule, the basic science and engineering of highly stable undercooled metallic liquid, and new academic an engineering values of the bulk metallic glasses which are significantly different from conventional bulk crystalline alloys. Various production techniques to form bulk metallic glasses directly from liquid have also been developed by utilizing the uniqueness of undercooled metallic liquid. Owing to their useful properties and three-dimensional bulk forms in conjunction with the direct production processes, bulk metallic glasses have been used as commercial materials in a variety of fields. In addition, even at present, many interesting properties and phenomena for bulk metallic glasses and their related undercooled liquid have continuously been found, and hence bulk metallic glasses are expected to maintain further increasing interest in the near future. This seminar presents the development history, fundamental properties, engineering characteristics, commercialization examples, recent topics and future prospects for bulk metallic glasses.



V15 **GKN Sinter Metals**
Radevormwald, Germany

Roland Käppner
Global Director Hydrogen

Industrial scale solid state hydrogen storage - recent advancements and applications

Metal Hydrides for storage of hydrogen have undergone intense empirical and scientific evaluations throughout the last decades. Numerous applications have been developed, and several, semi-commercial products been launched on the market. However, large scale economic breakthrough has never been achieved so far, unless few niche applications. GKN has identified hydrogen storage as a key issue for our future energy infrastructure and is approaching a potential breakthrough of metal hydride solutions from a global manufacturer perspective. Leveraging mature and efficient production processes for metal powders and compacted semi-products, GKN is currently pairing its capabilities with the long-year experience of academia and small start-ups for creating economic hydrogen storage solutions based on metal hydrides. First results on low-temperature, ease-of-process FeTi-systems will be shown.

V16 **Osnabrueck University of Applied Sciences**
Institute of Materials Design and Structural Integrity
Osnabrueck, Germany

Prof. Dr. Ulrich Krupp
Head of Institute

Development of Ultra-Fine-Grained Creep-Resistant Aluminum Alloys by High-Energy Milling

An excellent stiffness-to-density ratio, high corrosion resistance and the possibility of different kinds of precipitation strengthening makes aluminum alloys the most important light-weight material in aerospace and automotive industries. However, due to the low melting point of aluminum, applications at elevated temperatures are limited. At elevated temperatures aluminum alloys are prone to creep damage. Furthermore, above 200°C grain growth and coarsening of strengthening phases lead to a loss in strength. By dispersoide strengthening, these disadvantages can be compensated. In this study, nanostructured zinc-ferrite-strengthened aluminum alloys are produced by high energy ball milling followed by direct hot extrusion. Several analyses were made to show the potential of this kind of material for applications at elevated temperatures. Mechanical testing revealed superior properties in strength and creep resistance, which can attributed to the ultra-fine grained microstructure with fine dispersed particles at the grain boundaries as it was shown by scanning and transmission electron microscopy.

V17 **University of Siegen**
Graphene-based Nanotechnology
Siegen, Germany

Prof. Dr. Max C. Lemme

Two-Dimensional Materials: Potential Applications in Micro- and Nanoelectronics

The science and technology of two-dimensional (2D) materials is receiving considerable attention ever since the experimental discovery of graphene in 2004. Today, graphene is known only as the first of over 500 2D materials with a wide range of properties: semi-metals, metals, semiconductors and insulators can be found in nature and, more recently, synthesized in laboratories. Here, a particular subset will be discussed: graphene and so called transition metal dichalcogenides. First, an overview of scalable material synthesis and growth method will be given. Then, several examples for potential applications in electronics, optoelectronics and nanoelectromechanical systems will be presented that are based on the unique 2D material properties.

V18

TDC Corporation
Rifu/Sendai, Japan

Yuko Akabane
CEO & President

Super precise polishing technologies contributing Micro/Nano technologies

The world and it`s economy are changing from "large to small" and from "accuracy to high presision" very fast. In order to answer the demands on smaller technical units such as MEMS for both, molds and parts, surfaces and dimensions at higher precision are required. Surface itself impacts the performance e. g. of mirrors and of utmost passive interface demonstrated at the bring-back capsules for the Hayabusa Space Mission. Finishings achieved are in the single-digit-nano range, flatness and size tolerance in sub-micron level. This presentation also shows how intricate shapes and features in materials ranging from Metals, Ceramics, Resins and Crystals are processed.

V19

ZBT GmbH
the fuel cell research center
Duisburg, Germany

Dr. Volker Peinecke
Head of Department
Electrochemistry & Coating

Nanoscale HGS and mGS electrocatalysts for the oxygen reduction reaction (ORR) in a PEM fuel cell

The market introduction of PEM fuel cells in automotive applications very recently has become reality, fuel cell cars are available from Toyota, Hyundai and Honda (in early 2016). The automotive application of a PEMFC in general requires materials, which are low cost and simple to be processed, and which additionally show a very high performance at very low degradation rates under highly transient operating conditions. Looking at electrocatalysts for the ORR (air cathode) of a PEMFC, the automotive requirements still show the need of developing completely new types of materials, because the currently available materials are not yet "good" enough. One novel and very promising approach, is the development of a certain family of nanoscale graphite based catalysts, the so called "HGS" and "mGS" materials. In case of the HGS type - "hollow graphitic sphere" - catalyst the Pt particles with a size of 3-5 nm are "trapped" inside the pores of the shell of the HGS particle (diameter: 250 - 300 nm). In contrast, the mGS material - "mesoporous graphitic sphere" - is very similar to the HGS, but not having a void in the center of the sphere. In both cases, the low "mobility" of the Pt cristallites being trapped inside the pores, leads to an increased electrochemical stability, without causing a loss of O2 reduction activity and/or O2 diffusion properties (mass transfer).

V20

Massachusetts
Institute of Technology - MIT
Department of Materials Science
and Engineering
Cambridge, MA, USA

Prof. Dr.
Christopher A. Schuh
Department Head
and the Danae

Grain Boundary Alloying in Nanocrystalline Metals, from Theory to Practice

When the grain size of a metal is refined to a scale on the order of just a few nanometers, its strength, hardness, wear resistance and other properties improve in dramatic ways. There is therefore significant interest in designing and deploying such nanocrystalline alloys for structural applications. However, refining the grain structure is a struggle against equilibrium, and nanocrystalline materials are usually quite unstable; the grains grow given time even at room temperature, and the associated property benefits decline over time in service. The future of nanocrystalline materials therefore lies in stabilizing their structure, which in turn expands their processability and opens the door to application-relevant service lifetimes. This talk will review the concept of grain boundary alloying as a method to lower the energy of grain boundaries, which can bring a nanocrystalline structure closer to equilibrium and stabilize it for engineering use. The pathways from theory, to proof-of-concept laboratory demonstration, to scale-up and commercialization of such alloys will be highlighted. The current applications and future prospects of stable nanocrystalline metals will be described, including as substitute materials to reduce cost and cost volatility, as greener alternatives to legacy technologies and as next-generation structural materials with large performance increments over incumbent metals.

V21 **Korea Magnesium Technology Research Association**
Changwon City, Korea

Dr. Min Cheol Kang
Executive Director

Opportunities and Challenges with Magnesium for the Lightweighting

Magnesium alloys are the lightest structural metals, and have good physical and mechanical properties that make them extremely attractive for applications requiring light-weight materials. The global market for magnesium alloys has steadily expanded in the past decade, stimulated by the strong demand from the automobile and electronic industries for lightweight magnesium components. The mechanical behavior of magnesium alloys show strong anisotropic characteristics that originate from their hexagonal close packed (HCP) crystal structure. In order to meet the demand of new high performance alloys and overcome technical challenges, there has been active research at a number of universities, national research institutes and industries to develop new magnesium alloys and processing technologies in the world. This lecture outlines magnesium processing in Korea with a focus of growth in automotive and R&D and future by additive manufacturing (3D-printing).

V22 **University of Hyderabad**
Hyderabad, India

Dr.-Ing. V.V.S.S. Srikanth
Assistant Professor

Novel Graphene Based Materials for Diverse Applications

With the advent of graphene, research interests in it and in its family have considerably increased. Even though many plausible applications of graphene based materials have been clearly identified, most of the development was limited to only laboratories. In this presentation, industrially viable material processing methods and the diversity in use of these materials in applications will be discussed. The processing methods include those which give varieties of graphene (namely graphene oxide, reduced graphene oxide/few layered graphene, doped few layered graphene) and composites (metal oxide as well as polymer) of graphene. Use of different graphene based materials in applications namely As(III) removal from water, dye removal from textile effluent, plasmid DNA separation, durable SERS substrates, wearable human temperature sensor, energy storage (supercapacitors, Li ion batteries and dye sensitized solar cells), EMI shielding and cement composite preparation will be presented.

V23 **University of Ulm**
Institute of Micro and Nanomaterials
EUREKA
Metallurgy Europe Cluster Office
Ulm, Germany

Prof. Dr. Hans-Jörg Fecht
Director

Metallurgy Europe: the new EUREKA cluster in the field of materials science

While it is true that innovation often comes in the form of well-designed components and clever combinations of pre-existing elements, the discovery of novel materials can open up new realms of possibility, and give rise to a flood of potential products and applications. Historically, materials science has often contributed the optimized substances necessary to fabricate fast cars, tall buildings and strong components – but in recent decades, it has taken on a second, more subtle role as the originator of advances in fields including electronics and chemistry and application driven.
Materials science has always been a topic of crucial significance to industry, and therefore also to EUREKA. EUREKA has evolved accordingly, implementing initiatives such as the Metallurgy Europe cluster with the support of 280 industrial partners and top research institutions. Metallurgy Europe has been launched in 2014. It is concerned with the discovery and design of high-value metal products, and is set to run into 2021.
Since the cluster is still in its start-up phase project numbers cannot be given but the first "call for ideas in 2015" indicates that in the European Metallurgy Europe community a budget of at least 200 Mio. € is being considered as realistic in the first project phase including strong industrial contributions.

V24 **Tohoku University**
Sendai, Japan

Prof. Dr. Sergey Komarov

Fabrication and characterization of surface composite layers produced by ultrasonic-assisted shot impact treatment

The present work continues author's investigations on a novel process of coating and surface modification developed by the authors earlier. The process, named UMCA, uses high intense ultrasonic vibrations to accelerate 0.1~4 mm shots in a treatment chamber and thus to provide the following treatments in one operation step: 1) grinding of metal or/and ceramic powders, 2) transferring of the powder particles onto the surface of metal or ceramic substrate, 3) severe deforming and hammering of the particles into substrate surface layer, 4) cold hardening and cold welding of the particles onto the substrate. The process can be performed at room temperature and atmospheric pressure, and offers a great flexibility in choosing materials for substrate and coating.
At this stage, the main focus was on investigating immiscible systems Cu-W, Cu-Fe, Cu-Mo. It was shown that the UMCA process is capable of fabricating composite layers of the above compositions on copper or alumina substrates. The obtained results are discussed in terms of plastic flow and cold welding phenomena.

V25 **Zoz Group**
Wenden, Germany

Prof. Dr. Henning Zoz
CEO & President

Present Major Goals in Nanostructures & Concluding Remarks

Modern mankind is solving all its challenges with energy. The bottleneck in that is represented by the availability of a limited resource by nature: materials. This leads to the understanding, that there is no waste on this planet but material, leads to ultimate recycling and to the requirement of increasing the materials performance - making more with less.
Thus functional units are becomming smaller and smaller, thus materials structures following the same path. That explains why nanotechnology likewise nanostructured materials either are or will be applied practically everywhere.
Insofar it is not surprising, that also at Zoz, "the Nanostructure Company" since 25 years, the range of processing equipment and materials manufacturing/processing development covers quite a wide range in both, application/utilization and market goal.
This presentation gives a brief survey on present equipment, products and projects and future plans from High Kinetic Processing to High Performance Concrete to Hydrogen & Energy to ODS.

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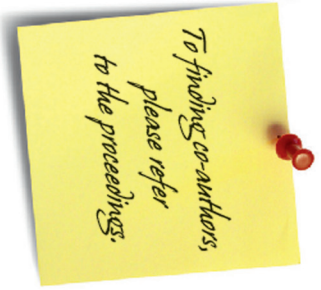

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P01

RHP-Technology GmbH
Seibersdorf, Austria

Dr. Erich Neubauer
Managing Director

Titanium Matrix Composites with high specific stiffness manufactured by rapid densification techniques

There is a number of space applications where there is a requirement for materials having a high specific stiffness. Typically metals and alloys have a specific stiffness which is in the range of 25 – 30. Composites such as Aluminium based materials (e.g. Al-SiC with a high filler content) are limited in their temperature range of application and SiC fiber reinforced titanium matrix composites are high in costs and the number of companies able to produce these type of materials is limited.
Within this work different candidate materials have been assessed and prepared by powder metallurgical processing techniques. Amongst the materials which are able to obtain a specific stiffness value of > 50 there are candidates such as Titanium filled with B4C, TiB2, TiC or carbon based materials. Besides the assessment and characterisation of the Young´s Modulus, the tensile strength and hardness was characterised.

P02

CIITEC-IPN
T & I Research Center - National Polytechnic Institute
Santa Maria, México

Prof. Dr. Sebastián Díaz de la Torre

Aluminum bars produced by Spark Plasma Sintering SPS and Extrusion SPE

Using a specific graphite-dies design and a commercial spark plasma sintering SPS 1050 device, aluminum matrix bars have been prepared at laboratory scale, starting from pure aluminum and Al-5083 powders, containing 0 and 0.3 vol% carbon nanotubes. Limited to the used SPS apparatus features, aluminum composite bars were prepared as long as 60 mm and from 5 to 15 mm in diameter. Thus prepared bars are released from a graphite matrix die which allows direct extrusion of the electrically energized powder. The graphite-dies design plays a fundamental role since its geometry and dimensions might locally concentrate energy, thus influencing microstructure and therefore final properties of extruded products. In this work, it is presented the SPS-SPE process and part of the properties attained in these aluminum bars.

P03

Siegen University
Innovation and Competence Management, remonet Project
Siegen, Germany

Feriha Özdemir
Research Associate & Doctorate Student

Multi-modal mobility concepts of the future - service innovation as a systemic process

Studies indicate that eMobility will emerge in urban areas. Redesigning and changing urban mobility solutions, eMobility is intended with a huge potential of sustainable innovation. However, changing the mobility culture depends on the consideration of certain requirements. Urban and rural areas were developed car-friendly focusing on automobile mobility of private transportation. According to John Urry, the automobile development lies in breaking the dominant role of cars (system of automobility) which results in a development deadlock. Changing the mobility culture, two central factors characterizing the automobile society are important: the mental approach to mobility options and the infrastructural conditions. Future mobility isn´t about less mobility, but rather a different way to be mobile. The research project remonet (regional emobility network) seeks to introduce the conditions of eMobility in an urban area without a well-utilised local public transport by a networked innovation cooperation with 5 companies, including Zoz GmbH, the city and the University of Siegen which happens in 4 development areas.

P04

CIITEC-IPN
T & I Research Center - National Polytechnic Institute
Santa Maria, México

Prof. Dr. Sebastián Díaz de la Torre

Comparative Tensile Strength of Aluminum Flat-Strip-Composites by High Energy Milling and Hot Extrusion

Aluminum base flat-strip-composite bars made out of Al-5083 powder thoroughly mixed with Al2O3 have been prepared in this work. The preparation route included high energy milling of Al-5083 and Al2O3 powders for about 1 h under inert gas atmosphere before being hot extruded into 6 x 20 x 1500 mm flat-strips. For tensile-strength and hardness comparison purposes, both Al-5083 pure and Al-5083-carbon nanotubes CNT containing flat-stripes were produced. The later series of material, also called Zentallium® attained the largest tensile strength followed by the -Al2O3 and -pure series, respectively. The hardness values disclosed same trend; i.e., largest for Zentallium®. The opposite trend is true in the case of the plastic behavior; i.e., pure Al-5083 specimens deformed much more in contrast to -Al2O3 and Zentallium®. The general features of flat-strip Al-5083/Al2O3 composites are compared with the other analyzed series and presented in this work.

P05

Advanced Materials JTJ
Kamenne, Czech Republic

Dr.-Ing. Jan Procházka
President

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P06

Kunming University of Science & Technology
Kunming, Yunnan, P. R. China

Prof. Dr. Xiaolan Cai
Faculty of Metallurgical and Energy Engineering

Preparation of Carbon Nano tube /Copper-base (CNT/Cu) Composite powder by Electro-deposition and High Energy Milling

This paper introduced the preparation method of carbon nano tube of copper-base (CNT/Cu) composite powder by electro-deposition and high-energy milling, including the technical study of CTN surface purification, modification, dispersion; the formula of composite electro-deposition. The research results indicate: there is a prominent effect on CTN surface if we use different dispersant, however, the disparity of CTN could be improved by ultrasonic dispersion. Use the technology of electro-deposition and high-energy milling to preparation composite powder of CTN/Cu, the resistivity higher than 90% IACS and tensile strength exceed 400MPa, So could Improve the electrical property and mechanical property of composite powder use this technology.

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P07

Jiangsu Sino-German Innovation Center Co., Ltd
Changzhou, China

Dr. Xiang-Qian Zhou
CEO

The landscape of the Cement Industry in China

Chinas cement industry is undergoing massive changes these days. As the economy growth has slowed down so has the demand for cement due to less construction. Therefore the current market supply of cement exceeds the demand by far and has led to a 25% price cut during 2015. Moreover new environment protection regulations to fight air pollution through the manufacturing of cement and construction of housing and infrastructure projects will change the maximum emission limits and lead to new standards.

P08

Vardhaman College of Engineering Department of Humanities and Sciences
Hyderabad, India

Prof. Dr. Pasala Sarah
Dean Basic Sciences, Vice Principal

Go green - piezotransducers for high temperature applications

Piezoelectric materials that can be utilized at high temperatures without failure are required for applications in aerospace, automotive, nuclear/electrical steam and power plants, structural health monitoring, nondestructive testing, more efficient jet engines, etc. The operational temperature range of piezotransducers is limited by the sensing ability of the piezoelectric material at high temperatures, increased conductivity, mechanical attenuation and variation of the piezoelectric properties with temperature. The properties relevant to sensor applications, including piezoelectric materials that are commercially available and those that are under development are discussed.
Piezotransducers are of increasing interest in comparison with other high-temperature sensing techniques due to their low cost, compact sensor size and simple signal conditioning.
Bismuth Layered Structured Ferroelectrics (BLSFs) are found to be suitable materials for these applications because of their thermal stability ~ 600°C and high electrical resistivity (>106 Ω cm). These materials allow operation at high temperature and harsh environment.
Lead free environment friendly BLSFs modified by rare earth elements are found to have electromechanical coupling factor comparable to that of lead based piezoelectrics.

P09

Microtrac GmbH
Krefeld, Germany

Dr. Thomas Benen
Sales Manager D-A-CH

Dynamic Light Scattering 2.0 - increased sensitivity for nanoparticles using the Frequency shift method instead of PCS

Dynamic Light Scattering (DLS) analysis is the basis of a common particle sizing measurement based on Brownian motion, which is applicable for particles from a nanometer to several microns.
At the nanometer end of the range, measurement becomes progressively more difficult as the particle optical scattering coefficients drop sharply, reducing the scattered light intensity. Dynamic light scattering signals are traditionally analyzed by autocorrelation function (time domain), also known as photo-correlation spectroscopy. As the frequency of scattered light is altered by moving particles compared to incident light, an alternative approach is to analyze the frequency shift of the power spectrum (frequency domain). A controlled reference amplifies frequency shift signals and allows for detection of very low signals. On the other hand, very high concentrations can be measured with the same instrument as it uses a 180° backscatter detector.
The advantages of these features are combined in a new series of nanoparticle sizing instruments to deliver accurate and sensitive size and Zeta potential measurements in the range of below a nanometer to several microns.

P10

Karlsruhe Institute of Technology KIT Institute for Applied Materials
Karlsruhe, Germany

M.Sc. Tim Gräning
PhD Student, Researcher

A novel approach in the field of austenitic ODS steels

Austenitic oxide dispersion strengthened (ODS) steels are promising candidates for high temperature applications in solar or future fusion power plants. Due to their lattice structure, austenitic steels have the potential to sustain higher temperatures in comparison to ferritic steels associated with an excellent creep resistance. Besides, austenitic steel are just paramagnetic, which makes them ideal candidates for a variety of applications in environments with strong magnetic fields - as in case of a tokamak.
But austenitic steels are prone to irradiation swelling which is a serious draw-back and show low mechanical properties. These drawbacks can be overcome by adding high temperature stable oxide nanoclusters, which increase the yield and tensile strength combined with the benefit of decreasing the rate of diffusion along grain boundaries with an inherit stability of the grain size at elevated temperatures. These features boost the suitability for the application in hazardous environments and the versatility of austenitic steels to a new level, if the production rate can be raised and a process control is established.

(shortened - pls. see proceedings)

P11

SENAI Innovation Institute for Electrochemistry
Curitiba, Brazil

Dr. Nério Vicente Júnior
Chief Researcher Materials

Innovative processes & products using applied research in the state of the art in Electrochemistry

The Senai Innovation Institute for Electrochemistry (ISI EQ) has promoted and enhanced the applied research into Brazilian industries, seeking to equalize it with the industrial major players level. In the field of nanotechnology the ISI EQ has dealt with innovation projects using the relative new technology known as Spark Plasma Sintering (SPS). Each project has been financially supported by gain a private funding after approval in a national competition. These projects have been conducted into the laboratory of materials using high energy milling and SPS. In order to evaluate the proof of concept based on literature experimental procedures have been done following international standards. The capability of the SPS process to efficiently promote the powder densification and consolidation have been comprised. Some materials in current development are the nanostructured ionic conductive yttria-stabilized-zirconia (n-YSZ) and the nanostructured proton conductive yttrium-doped-barium zirconate (n-YBZ), both for fuel cell application; and the nanostructured ionic conductive lanthanum-lithium-niobium oxide ((La,Li)NbO3), for lithium-air battery; the harmonic meso-nano structured Ti grade 5, proposed by Prof. K. Ameyama is also studied.

P12

Centre Terre et Pierre (CTP)
Tournai, Belgium

Dr. Hervé Bréquel
Manager of Collaborative Research Department

Substitution of commercial chemicals by activated by-products for solidification / stabilization of contaminated soils.

An original combination of geopolymer and hydraulic binders is tested at laboratory scale for polluted soils solidification/stabilization processes, in order to prevent leaching of heavy metals. In order to minimize the cost of the formulation, especially in the case of chemicals for the geopolymeric parts, substitution by industrial by-products is sought. Recycled silica glass is used as a source of Si, when blast furnace slag is used as a source of both Si and Ca. They are usually chemically activated with KOH, but an alternative is to activate mechanically those materials, using intensive ball milling. A comparison of the results obtained is presented, especially regarding the properties of each compound, and the final properties of testing material made with the formulation to measure compressive strength and perform leaching tests.

P13

FH Aachen, University of Applied Sciences
Aachen, Germany

M.Sc. Miranda Fateri
PhD student, Head of Glass Dept.

Fabrication on the Moon using Lunar Regolith

Additive Manufacturing (AM) processes are among the key candidates for fabrication of demanding parts on celestial bodies. In addition to the fully robotics nature of AM techniques, its characteristics of energy source and powder based fabrication process are suitable for using in situ material. With respect to this, the feasibility of AM processes of Lunar fabrication is studied in this research.
The project is part of a long-term strategy for the settlement of celestial bodies. This requires "in situ" manufacturing of shelters against radiation and meteoroids as well as the making of various mechanisms. Fabrication must use available materials where delivery from earth is not an option mainly for economical reasons. Preferred materials are Moon sand (Lunar Regolith) and Mars sand respectively which both are a kind of glass-ceramics.
The material was composed at the FH Aachen at the „GoetheLab for Additive Manufacturing" according to the NASA recipe.
The 3D Printing Process was designed and optimized to allow the fabrication of complex 3D objects from Lunar Regolith. The early parts presented here explain the working principle and provide the basis for scaling up the process.

P14

Zoz GmbH
Zoz Technology Center
Wenden, Germany

Deniz Yigit
Head of R&D Division

High performance zinc-flake pigments by high kinetic processing for anti-corrosive coatings with manifold applications

Metallic high performance zinc-flake pigments (ZFP) obtained by high kinetic processing (HKP) lead to a new generation of zinc-flake coatings in private sector as well as in industrial applications and provide a long-term corrosion resistance. Zoz ZN-CP301 anticorrosive paint establishes the cost-effective HP-ZFP technology. Epoxy-resin based systems are proved and the development of water-based ZFP-systems shows great promises for coating systems without chemical H2-gassing of zinc.
Corrosion will stay one of the biggest global problems in the 21st century due to destruction of steel constructions, plants, rail tracks, tubes, vehicles and machines. As a given fact 16 tons of steel are destroyed per day caused by corrosion. The German public railway is estimated to spend about 5.5 billion (10^9) € until 2016 because of the calculated end of service life-time is reached within 70% of all steel and railway bridges (source: Deutsches Lackinstitut). 3.3 trillion (10^{12}) US$ was the annual cost of corrosion worldwide in 2011 which is over 4% of the world's GDP (source: DECHEMA). This cost includes maintenance, prevention, replacements of corroded parts and interruption of services due to maintenance.

P15

Zoz GmbH
Zoz Technology Center
Wenden, Germany

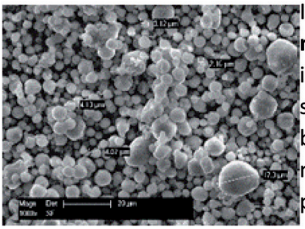
Dipl.-Ing. Andreas Franz
Hydrogen Storage &
H2Tank2Go® modules

Hydrogen related activities at Zoz GmbH

In order to secure the world's energy demands of tomorrow, the current dependency on fossil fuels will not be sustainable for much longer. To compensate a growing population and world economy together with depleting resources and increasing pollution, the answer can only be found in clean, renewable energies like wind- and solar power.
As an energy-storage-medium, hydrogen can play a key factor in the future's energy-economy. Not only is it able to store the surplus-energy from wind and solar, it can also provide an alternative fuel for "zero-emission"- electric vehicles. Hydrogen is basically available everywhere on the planet (electrolysis of water) and therefore a prime candidate to become the "fuel of the future".
Apart from the wide range of different areas in research and development, hydrogen technologies play a major part at Zoz GmbH. This poster-presentation will summarize current and future developments regarding energy consumption and electro mobility and give an overview over all projects that are related to hydrogen at Zoz GmbH.

nanoHVOF®-powder – It's fine to work with

Thermico has developed plasmaspherodized powder <10 µm

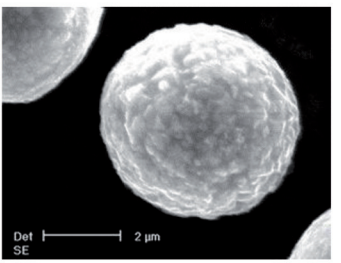


In collaboration with aviation industry, Thermico developed **nanoHVOF®-powders**. The most specific in **nanoHVOF®-powder** is the controlled plasma treatment that results dense and spherical particles with a submicron and nano-scale grain size below 10µm. This method can be applied on metallic raw materials such as WC-CoCr as well as on MCrAlY or Aluminum to produce nanoHVOF®-powder.

Thermico also supplies various powders, based on tungsten and nickel raw material.

Thermico sets standards with its plasmaspheroidization plant-technology

The plasmaspheroidization plant-technology is unique and optimized for melting powder particles into nanoHVOF®-powders. This allows the production of nanostructured WC-based agglomerated and sintered powders with grain-sizes of less than <10µm.



This technology even sets standards for thermical coating. Nano-scaled WC and Cr3C2 powders with a grain size less than 10 µm are receivable in a spheroidized form now.

Caused by the dense structure of these powder grains, smooth and very resistant ID-coatings get possible.

Thermico enables thermal spraying for challenging applications

Thermico has well-established the nanoHVOF-coating of inner diameters down to 63 mm by using a rotation torch. This is the perfect solution because despite of a small coating distance and a low thermical performance of the HVOF-plant (<40kW) pore-less coatings with a roughness of <1,3 µm can be produced.

For further information please have a look on our homepage: WWW.Thermico.de or simply get in contact with us: Ines.Schwochow@thermico.de

P16

Zoz GmbH
Zoz Technology Center
Wenden, Germany

Dr. Birgit Funk
Coatings & Cement, Chemistry

From slag to High Performance Concrete - manufacturing FuturBeton

FuturBeton, a high performance concrete is of great ecological and ecnomical interest. FuturBeton provides high strength and durability due to nano-activated ground granulated blastfurnace slag (GGBS). The application of GGBS in general slag cements leads to CO2-emission saving by substitution of clinker in cements but normally causes a decrease of reactivity and strength because of its low hydraulicity. For a high performance building material an high effective cementitious binder with high reactivity is inevitable. FuturZement is such a binder and it contains nanostructured GGBS activated by high kinetic processing (HKP) applying the Somolayer® technology. HKP-GGBS is highly reactive. The way of manufacturing such innovative high performance materials implements different crucial processes as pre-fabrication, activation, blending and mixing.

P17

Zoz GmbH
Zoz Technology Center
Wenden, Germany

Dr. Chaoren Liu
Marie Curie ITN experienced researcher
solid state absorber & battery

Mechanical relaxation behaviour in several metallic glasses

Relaxation phenomenon is a time related behaviour toward equilibrate state. With the amorphous structure, how the glass respond under different stimulus is of great interest to the physicist and is regarded as one of the most important problems in modern physics. With spherically symmetric atomic potential, metallic glass (MG) offered a simple model system can be easily simulated and verified by experimental techniques. In this work, the relaxation dynamics of several MGs (Pd-Ni-Cu-P, Cu-Zr-Al, Fe-Cr-Mo-C-B) are explored by dynamic mechanical analysis (DMA). Different relaxation behaviour is observed and analyzed in physical model.
Due to its unique properties, MG is of great interest to the materials community as well. With high magnetic permeability and electrical resistance which are helpful for reducing the eddy loss, MGs with excellent soft magnetic properties have been widely used in the transformer with lower loss. High elastic limits, good corrosion resistance, ability to deform in viscous region are also properties of interest. The temperature dependent viscosity is essential for the determination of processing conditions for shaping the MGs. In this work, a method is developed to obtain the viscosity of MGs.

P18

University of Stuttgart
Institute of Material Science
Stuttgart, Germany

M.Sc. Efi Hadjixenophonotosk
PhD student, Early Stage Researcher

MgH2 sorption kinetics and electrochemical battery performance in thin films

Magnesium hydride (MgH2) is a model material which is intensively studied for hydrogen sorption in the last few years. Beside its favorable abundance, it is known for its high weight capacity of about ≈7 wt.% of hydrogen (H) and its reversibility as a storage system. However, it suffers from slow kinetics which makes it operational at only high temperatures. Research has shown that transition metals (TM) can improve these properties. E.g. it requires a thin Palladium (Pd) film on top for the hydrogenation to take place. In this work, we focus on the H-sorption kinetics in thin films of thicknesses between 50-400nm in different conditions. Pure metals of Mg/Pd layers were deposited by ion beam sputtering on SiO2 substrates. Hydrogenation of these layers followed at different temperatures (RT-300°C) and for different duration of times (10-600min) at 1-20 bars of H atmosphere. Full dehydrogenation of the samples has been tested at temperatures lower than 300°C. XRD is applied to quantify the hydrogen-sorption process and diffusion coefficients. Quantitative measurements and evaluation allow determination of diffusivity and surface reaction coefficients.

P19

Aarhus University
Interdisciplinary Nanoscience Centre (iNANO)
Aarhus, Denmark

M.Sc. Priscilla Huen
PhD Student

Nanoconfined metal hydride as anode of Li-ion batteries

Metal hydrides as anode materials for Li-ion batteries are receiving increased attention due to the high theoretical capacities and relatively low cost. However, the large volume change and particle growth during operation leads to poor reversibility. Through nanoconfinement, the size of particles is limited to the pore size of the nano-scaffold. In addition, nano-scale diffusion distances facilitate transport of Li-ions and enhance the kinetics of the conversion reactions.
In this study, we present the improved electrochemical performance of sodium aluminum hydride, NaAlH4 through nanoconfinement in meso-porous carbon scaffold. We have investigated the reaction mechanism of the conversion reaction by operando synchrotron radiation powder X-ray diffraction (SR-PXD), and found important differences between nano-confined and non-confined samples. The electrochemical reactivity of empty carbon scaffold and its contribution to the battery performance will also be discussed.

P20

Aarhus University
Interdisciplinary Nanoscience Centre (iNANO)
Aarhus, Denmark

M.Sc. Seyedhosein Payandeh Gharibdoust
PhD Student

Tuning the hydrogen storage properties of the rare-earth borohydrides by forming bimetallic compounds

At 143.0 MJ/kg, hydrogen has the highest energy density of common fuels by weight and can be used as energy carrier. However, storing hydrogen was always a big challenge. Extremely high pressures up to p(H2) = 700 bar are required to store sufficient amount of hydrogen in a car. Using liquid hydrogen requires keeping the temperature at 21 K. One solution is to use materials that could form chemical band with hydrogen. Borohydrides are classified in this group and have very high hydrogen contents (LiBH4, ?m = 18.5 wt%). However, they show poor thermodynamics and kinetics in hydrogen absorption/desorption. In this work, a pure rare earth borohydride is synthesized. In order to improve the hydrogen storage reversibility, it reacted with alkali metal borohydrides and several new bimetallic borohydrides are formed. The crystal structures of the new compounds are solved from powder diffraction data and their hydrogen storage properties are characterized.

P21

Kyoto University
Institute of Advanced Energy
Kyoto, Japan

Prof. Dr. Akihiko Kimura
Director

Karlsruhe Institute of Technology - KIT
Institute for Applied Materials
Karlsruhe, Germany

Dipl-Ing. Rainer Lindau
Senior Researcher

Development of nano-scaled ODS Steels at Kyoto University and KIT

Nanostructured, oxide dispersion strengthened (ODS) steels produced by means of “mechanical alloying” are candidates for application as nuclear and blanket structural materials in nuclear fission and fusion power plants. Due to their high tensile and creep strength at elevated temperatures the operational temperature can be elevated by at least 100 °C up to 650 - 700?C. By introducing nano-scaled ultra-fine oxide particle dispersions acting as trapping sites for radiation defects and gas atoms the radiation tolerance was also considerably improved. (9-12) Cr-ODS ferritic/martensitic were developed for application in sodium cooled fast reactors and as reduced activation variant for future fusion power reactors. The addition of Al to (14-16) Cr-ODS ferritic steels improves the corrosion resistance in super critical water and compatibility to liquid metals significantly. Additions of Zr and Hf allow controlling the oxide particle size and density as well as the grain size, thus making this material applicable for advanced Gen IV reactors (SFR, SCWR, LFR). An increase of the Al content to 8-12% further increases the oxidation resistance in light water. It has been proposed to replace Zr claddings in LWRs by “accident tolerant” high Cr - high Al ferritic steels since the hydrogen production in a severe accident is much lower below 1200°C. The presentation will give an overview on the work at Kyoto University which R&D covers materials for fission and fusion reactor materials while the work at KIT concentrates on fusion relevant applications.

P22

Kyoto University
Institute of Advanced Energy
Kyoto, Japan

Prof. Dr. Akihiko Kimura
Director

Accident Tolerant Fuel Cladding R&D -ODS Steels with high corrosion resistance

Severe accidents (SA) in nuclear power plants (NPPs) are unlikely events but with serious consequences, as recently shown by the accident that occurred in April 2011 in the Fukushima Japanese NPPs. SA research started originally in the seventies with initial risk assessment studies and later on with experimental programs, development of numerical simulation codes, and Level 2 Probabilistic Safety Assessments (PSA2). Hydrogen produced by core degradation is released into the containment, where it burns on contact with oxygen, provoking a pressure and temperature spike which may damage the containment building. This combustion can either be slow acting (slow deflagration) or more rapid (rapid deflagration) and, in some cases, explosive (detonation). Hydrogen combustion may lead to the loss of the containment barrier: a commitment to making this risk residual has been demonstrated by the progressive implementation of hydrogen Passive Autocatalytic Recombiners (PAR) in many NPPs.

P23

Friedrich Schiller University Jena
Institute for Technical Chemistry and Environmental Chemistry (ITUC)
Jena, Germany

Dr. Achim Stolle
Group Leader

Ball mills as tools for sustainable syntheses

Chemical reactions in both laboratory and industry are nowadays not assessed by their yield only, but also by metrics displaying their ecological and economical footprints. On the road to sustainable chemistry, variables like the E-factor become important for process intensification. In synthesis, extensive solvent-use accounts often for low sustainability of the reaction expressed by a high E-factor. Thus, reduction of the solvent amount is one out of the huge variety of possibilities to make a reaction greener. Although solvent-free reactions are very efficiently in the liquid-phase[1,2], problems regarding mass transport, energy entry, and energy distribution come up if heterogeneous reactions should be carried out solvent-free. One solution to overcome the mass-transport limitations is the installment of efficient mixing devices. Regarding this, ball mills are ideal tools combining system-inherently a high mixing efficiency combined with high energy densities due to mechanical forces. Thus, ball mills conquer their place among the tools for non-classical ways of energy entry favored in organic synthesis [3].

(shortened - pls. see proceedings)

P24

University of Oldenburg
Oldenburg, Germany

Prof. Dr. Gerd Kaupp

Mechanochemistry and solid-state syntheses by reactive milling including scale up

The separation of mechanochemistry against thermodynamics with mechanical bond-breaking of tribo-materials (1) and solid-state syntheses by contacting of powdered reactants (2) clarifies the mechanisms in both fields of ball-milling with the same mills at different processing. For example, the particular mechanism can also be distinguished at the milling with metals (3). Both fields are well established, as the mechanistic requirements can be easily adjusted. Mechanochemistry often requires high impact for breaking the tribomaterials to generate extremely energetic surface plasma that can produce ozone and nitrogen oxides in air and mineralizes all organic materials including dioxin down to graphite, H2O, HCl, CO2. With acknowledgment of all these convincing mechanical and practical facts, we performed mechanochemical inorganic syntheses and large-scale decontaminations (for example 30min 200g Duran glass and 0.21g of 3,4,8,9-tetrachlorodibenzo-dioxin with 0.3g congeners exhaustively mineralized in a 2L Simoloyer® with 1300 rpm) (4).
With non-mechanochemical milling hundreds of syntheses of virtually all known reaction types succeeded in small vibration mills, and several ones in 2L and 20L Simoloyer® mills, with perfect out-milling features through cyclone and little holdup with quantitative yield in the second batch and so on. Continuous production by milling is thus enabled.

DEVELOPMENT OF COMPOSITE CONCRETE WALLS FOR THE PHYSICAL PROTECTION (SHIELDING) OF MILITARY BUILDINGS.

P25

Helmholtz-Zentrum Geesthacht - HZG
Helmut-Schmidt-University - HSU
University of the Federal Armed Forces at Hamburg
Geesthacht & Hamburg, Germany

Prof. Dr. Thomas Klassen
Director of Materials Technology Div. at HZG
Head of the Institute of Material Science at HSU

Nanostructured Materials for Hydrogen Technology as Key to Sustainable Mobility

Hydrogen is the ideal clean energy carrier for our future sustainable energy economy as well as for zero-emission mobility. Recent research on nanostructured materials for efficient renewable production and reversible storage of hydrogen will be presented. Different aspects from basic materials development to systematic science-based scale-up and system design will be covered.
Certain nanocrystalline semiconductors are photocatalytically active and can be used for water splitting in photo-electrochemical cells. For this study, nanocrystalline TiO2, BiVO4, and WO3 coatings were produced by cold spraying. In cold spraying, particles are accelerated in a gas stream to velocities of more than 800 m/s and bind to the substrate upon impact. Binder agents are not required, and TEM micrographs show that the nanocrystalline microstructure is retained. The initially present secondary structure of the nanoparticles bursts on impact leaving behind the primary nanocrystals and resulting in a large active surface area. The coatings show high photo-currents for hydrogen production by solar water splitting.

(shortened - pls. see proceedings)

P26

University of California - Berkeley
Department of Nuclear Engineering
Berkeley, CA, USA

Prof. Dr. Peter Hosemann
Associate Professor and Vice Chair

Microstructure and mechanical properties of CuxNb1-x alloys prepared by ball milling and high pressure torsion compacting

New CuxNb1−x alloys were prepared using a two-step process of ball milling and subsequent high pressure torsion compacting at ambient temperature. The alloys showed a nanocrystalline structure with grain sizes between 13-26 nm for the Cu-rich samples and 11-13 nm for the Nb-rich samples. The grain sizes decreased with the milling time and the amount of Nb in the Cu-rich and Cu in the Nb-rich samples, respectively. The distortion of the crystallographic lattice of the fcc Cu and bcc Nb suggests the formation of a solid solution. The mechanical properties studied by nanoindentation show an increase of the hardness with milling time and the amount of added element. A thermal treatment was carried out under a protective Argon atmosphere. Up to 400°C the Cu-rich samples do not show significant signs of oxidation and in increase of hardness. The Nb-rich samples showed a continuous increase of the hardness up to 500°C, due to the precipitation of Cu, and the initial formation of NbOx.

P27

FH Aachen, University of Applied Sciences
Aachen, Germany

Prof. Dipl.-Ing. Heike Matcha
Construction & Architecture

Polyfunctional building elements through 3D printing

We study how recent and future 3D-Printing Technology can integrate several functions at once into building components that so far have only accommodated single functions.
Building components used in architecture have traditionally served only one function at a time: structure, insulation, technical installation were dealt with individually. This made sense as the requirements for the various functionalities are very different: most importantly structural stability, insulation against water intrusion and heat loss, secure distribution of air and liquids throughout a building. However, such separation means using a lot of material, and difficulty of assembly.
3D printing in fact allows to generate custom materials. So the functional deficiencies of the individual materials and building components can be overcome, and new materials and building components devised and manufactured that integrate several functionalities into one polyfunctional part.
We study those opportunities and their implication for future ways of erecting buildings, especially in terms of sustainable use of material and time. In particular, we investigate reinforced concrete formwork. We present our research, demonstrate its possibilities, speculate on possible future developments and discuss difficulties and problems and how to overcome and solve them.

P28

Brno University of Technology
Central European Institute
of Technology - CEITEC
Brno, Czech Republic

Ing. David Jech
PhD student

Influence of technological parameters on a quality of atmospheric plasma sprayed Al_2O_3+13%TiO_2 and Cr_2O_3 coatings

This work is focused on evaluation of quality of hard Al_2O_3+13% wt. TiO_2 and Cr_2O_3 coatings produced by means of atmospheric plasma spraying technique. The different technological process parameters, namely the plasma torch stand-off distance, gas flow rate, current, particle temperature and velocity were varied during deposition. In-flight particles temperature and velocity were monitored during spraying using Tecnar AccuraSpray G3C (on-line particle monitoring system) unit. The main aim of the contribution is to optimize a quality of resulting microstructure, with respect to the coatings thickness, amount of unmelted particles, microcracks and porosity at inter-splat regions, which were studied in detail. Based on the results obtained from AccuraSpray system and scanning electron microscope equipped with energy dispersive microanalyzer, the technological parameters providing optimal microstructure of both studied Al_2O_3+13% wt. TiO_2 and Cr_2O_3 coatings were identified.

P29

Brno University of Technology
Central European Institute
of Technology - CEITEC
Brno, Czech Republic

Dr. Ladislav Čelko
Deputy Head
of Research Group
Senior Researcher

Corrosion of Magnesium in simulated Physiological Conditions - X-Ray computed Micro-Tomography Analysis

Biodegradable metallic materials for medical applications have received considerable attention in recent years. The reason is that they provide high potential for fabrication of temporal orthopaedic implants such as bone fixation devices and scaffolds. Magnesium (Mg) is an excellent candidate for biodegradable implants due to its biocompatibility and relevance for biological body functions. Unfortunately, the high Mg degradation rate and high level of hydrogen evolution limits its application in medicine. Apart from necessity of decrease in corrosion rate of Mg, there is need for a robust, reproducible, accurate technique for quantification of in vitro and in vivo Mg degradation and also for evaluation of the effect of various surface treatments, performed to decrease its degradation rate. This research was focused on demonstration of X-ray computed microtomography (μCT) as a non-destructive, quantitative and multi-analytical characterization technique to assess the corrosion progress of high-purity-Mg (HP-Mg). The efficacy of the μCT was compared with that of conventional analytical methods which are commonly used for evaluation of Mg degradation.

P30

Università degli Studi di Torino (UNITO)
Marie Curie ITN ECOSTORE
Turin, Italy

M.Sc. Anna Wolczyk
Early Stage Researcher

Morphology Influence on Conductivity in $(LiNH_2)x(LiBH_4)_{1-x}$

The aim of this work is to investigate the relationship between microstructure and Li-ion conductivity in complex hydrides to be used as solid-state electrolytes for Li-ion batteries. Studied materials are combinations of $(LiNH_2)x(LiBH_4)1_{-x}$, where x=0.50 (Li_2BH4NH_2) and 0.75 ($Li_4BH_4(NH_2)_3$) prepared by different methods (QU-quenching and BM-ball milling). SEM and TEM characterization have been performed in order to investigate the microstructure. Rietveld refinement of XRD patterns was used to obtain strain and coherent domain size. QU sample turns out with a coarser microstructure with respect to BM sample. Ion-conductivity measurements provided insights on the role of defects on the Li-ion mobility.

P31

Nuclear Research Centre Negev - NRCN
Israel Atomic Energy Commission
Be'er Sheva, Israel

Dr. Ori Yeheskel
Group Leader PM

High Density Cerium Oxide Ceramics using Low Temperature Sintering

Gadolinium doped ceria (GDC) has various industrial applications. In addition these compounds have unique electrostriction properties. Porosity affects the physical properties like impedance, elastic properties and electrostriction. Effect of porosity on the shear modulus of various GDC compounds is shown in Figure 1A and typical scanning electron micrograph in Fig. 1B.
In order to reduce the porosity effect, attempts were directed to develop a method of pressure-less sintering to nearly full theoretical density. The success presented here, is due to combination of a well-controlled and reproducible synthesis of nanometric powder, and special two step sintering1 routes chosen for the various compositions studied (0-0.20 Gd).

(shortened - pls. see proceedings)

P32

Technische Universität Braunschweig
Institute for Particle Technology
Braunschweig, Germany

M.Sc.
Christine Burmeister
Ph.D. student

Experimental and computational investigation of solvent-free Knoevenagel condensation in ball mills

Chemical reactions in ball mills are a promising technology and recent publications show the applicability and advantages for various organic reactions under solvent-free conditions. Unfortunately, most published data cover syntheses in laboratory scale and literature for scale-up is rare. Up to now it is unclear which process parameters, especially stressing energy and stressing number, mainly influence the success of mechanochemical processes. Therefore, the Knoevenagel condensation of barbituric acid and vanillin was considered as model reaction in a planetary ball mill and in a high-energy ball mill which enables the scale-up of such processes. The reaction time for full conversion was investigated as function of process parameters like ball filling ratio and ball diameter for different mill types and scales. As the values of the characteristic mill parameters stressing energy and frequency are not accessible by experiments, numerical simulations based on the discrete-element-method (DEM) were carried out to quantify the stressing conditions.

(shortened - pls. see proceedings)

P33

SmartMembranes GmbH
Halle, Germany

Dipl.-Chem. Monika Lelonek
Managing Partner

Nano porous alumina materials with controlled pore diameters

Anodization is perfectly suitable for mass production, as demonstrated by the basic anodizing process being the standard industrial surface treatment, for protection against ageing, basis for coloring or functionalization. There are more than one thousand patents for producing and using these treatments. Production for nanotechnology in the form of free-standing membranes with well controlled pores requires a more advanced technological control. These membranes are defined by a hexagonal highly ordered honeycomb or cubic structure with low standard deviation of the pore diameter and interpore distance. The structural parameters such as pore size, lattice constant, the porosity, as well as the thickness of the membrane, can be precisely adjusted to the customers' needs in the nanometer range. Within the funded FP7 European project SmartMembranes works with an international consortium to develop the materials needed for such 3D memories based on magnetic shift-register devices, namely dense arrays of vertical magnetic wires in a matrix. In this concept series of bits are shifted along each wire, requiring only one read/write element per wire. Synthesis will rely largely on bottom-up routes to minimize production costs. In order to minimize risks, several strategies will be explored both for coding bits, data shifting, read&write schemes.

(shortened - pls. see proceedings)

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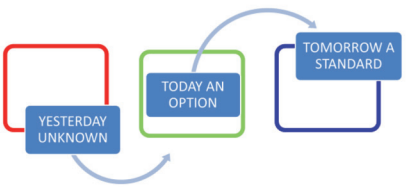

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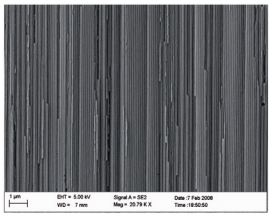
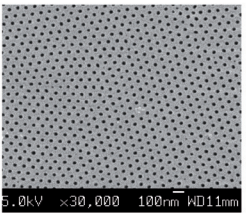
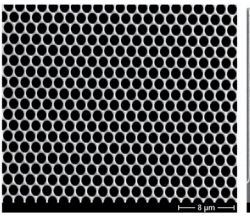
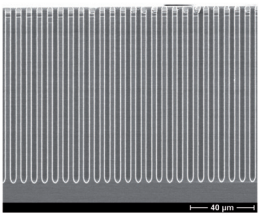
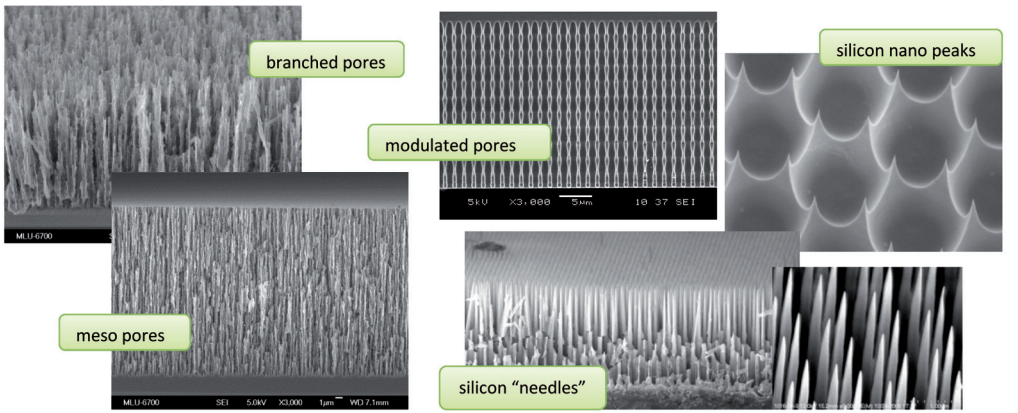
SmartMembranes is a producer of high quality macro and nano porous alumina and silicon membranes with high ordered structures and a narrow pore size distribution

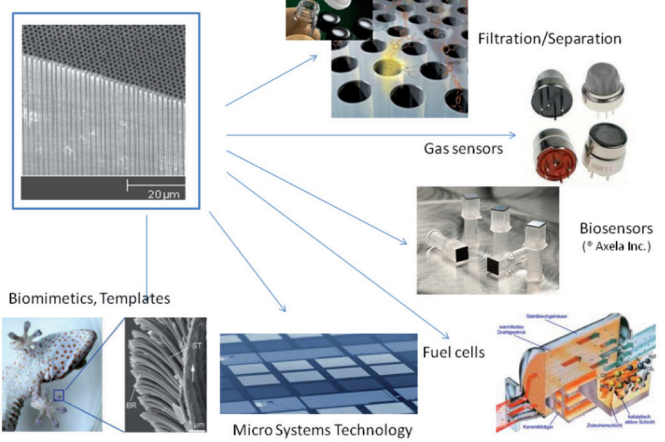
nano porous alumina
Ø Pore: 25-400 nm

macro porous silicon
Ø Pore: 0.8-15 µm



- precise pore diameter (deviation < 10%)
- high aspect ratio
- strongly parallel pore growth
- application in filtration, separation, platform for sensors, biochips, fuel cell electrodes, drug delivery systems, micro chips and as templates for nanorods and nanotubes



SmartMembranes GmbH | www.smartmembranes.de | sales@smartmembranes.de | Phone: +49 345 4780 -250/-251

9th International | 9th German-Japanese

Symposium on nanostructures

Exhibitors

Alphabetical list of exhibitors

Advanced Materials JTJ s.r.o.	CZ-27301 Kamenne	Czech Republic	E01
Analytical Tribology Network	D-48053 Muenster	Germany	E02
Centre Terre et Pierre (CTP)	B-7500 Tournai	Belgium	E03
CIITEC-IPN	Mexico D.F. 02250	México	E04
Cluster NanoMikroWerkstoffPhotonik.NRW	D-40239 Duesseldorf	Germany	E05
EnergieAgentur.NRW	EnergieAgentur.NRW	Germany	E06
EURECA Cluster EUROGIA2020	B-1200 Brussels	Belgium	E07
EURECA Cluster Metallurgy Europe	D-89081 Ulm	Germany	E07
GKN Sinter Metals	D-42477 Radevormwald	Korea	E08
Harke Group	D-45479 Muelheim a. d. Ruhr	Germany	E09
Helmholtz-Zentrum Geesthacht	D-21502 Geesthacht	Germany	E10
HZG Hydrogen Technology Centre Olpe	D-57462 Olpe	Germany	E10
HuK Umweltlabor GmbH	D-57482 Wenden	Germany	E11
Hydrogeit Verlag	D-16727 Oberkrämer	Germany	E12
IVAM Microtechnology Network	D-44227 Dortmund	Germany	E13
Japan External Trade Organization - JETRO	D-10117 Berlin	Japan	E14
Jiangsu Sino-GIC Co., Ltd	Changzhou 213000	P. R. China	E15
KAMI, Korea Advanced Machinery Inc.	153-789 Seoul	Korea	E16
Karlsruhe Institute of Technology - KIT	D-76131 Karlsruhe	Germany	E17
Korea Magnesium Technology Research Association	641-465 Changwon City	Korea	E18
Kunming University of Science and Technology	650093 Kunming, Yunnan	P.R. China	E19

Massachusetts Institute of Technology - MIT	Cambridge, MA 02139	USA	E20
MATSYS Inc.	Sterling, VA 20164	USA	E21
METALL- Journal for Metallurgy	D-38644 Goslar	Germany	E22
Microtrac GmbH	D-47807 Krefeld	Germany	E23
Nanoinitiative Bayern GmbH	D-97074 Würzburg	Germany	E24
Nano-in-Germany	D-40468 Duesseldorf	Germany	E25
NOW GmbH	D-10623 Berlin	Germany	E26
POROTEC GmbH	D-65719 Hofheim	Germany	E27
RHP-Technology GmbH	A-2444 Seibersdorf	Austria	E28
SENAI Innovation Institute for Electrochemistry	80530-902 Curitiba	Brazil	E29
SmartMembranes GmbH	D-06120 Halle (Saale)	Germany	E30
SMS group GmbH	D-41069 Moenchengladbach	Germany	E31
TDC Corporation	Tokyo 101-0052	Japan	E32
Thermico GmbH & Co KG	D-44263 Dortmund	Germany	E33
University of Siegen, REMONET	D-57076 Siegen	Germany	E34
Veloxint Inc.	Wayland, MA 01778	USA	E35
ZBT GmbH - the fuel cell research center	D-47057 Duisburg	Germany	E36
Zoz Group	D-57482 Wenden	Germany	E37
Zoz Technology Center (Excursion 1)	D-57462 Olpe	Germany	-50
Zoz Central Siegen (Excursion 2)	D-57072 Siegen	Germany	-51

OZ-16 post conference days

FuturZement|Beton & more | large scale demonstrations

time/day	Wednesday, March 09	Thursday, March 10	presentation	location
	FuturBeton demonstration, large scale, 2 tons			ZTC
10:00-11:45	special interest program FuturBeton incl. P/V27 Prof. Heike Matcha	encasing of FuturBeton-Eagle after 18 hours curing	onsite	
11:45-12:45	super-activation of GGBS, 100 kg	ASTM-compression strength of test-cubes after 19 hours curing	onsite	
12:45-13:30	lunch & discussion			
13:30-14:30	processing of FuturZement, 333 kg	Note: If there will be particular interest of the attendees, such demonstration on Zink-rich Coatings and ODS/NFA manufacturing will be added.		
14:30-15:30	processing of FuturBeton, 2.000 kg			
15:30-16:30	casting FuturBeton-Eagle & ASTM test-cubes			
16:30-17:30	reception & coffee			

OZ-Workshop 2016
at GIC, Changzhou
May 17-18, 2016, China

Photos partly provided by Ms. Julia Knop (Helmholtz-HZG) and Dr. Min Cheol Kang (Executive Director, Korea Magnesium Technology Research Association, official OZ-Photographer). We appreciate this fabulous support - thank You !

OZ-Workshop 2016
at Matsys Inc., Sterling VA
August 12, 2016, USA


OZ-15
[OZ-16]
9th German-Japanese | 9th International
Symposium on Nanostructures
March 6-8, 2016
Wenden, Germany
nano
structures
OZ-16 will provide a small but first-class technical program to cover aspects in a niche and at the same time super important field of nanostructured materials in applied science and technology for industry, life, energy and nature-saving.
[OZ-16: addresses]
[OZ-16: opening & ceremonial lecture]
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ottobock.
no parallel sessions
no conference fee
no exhibition cost
but first class speakers and exhibitors from a small but excellent society
OZ-12
OZ-14


OZ-14 & OZ-12
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