WORLD PM2022
CONGRESS & EXHIBITION

ABSTRACTS – GROUP 9

APPLICATIONS

WORLD PM2022
CONGRESS & EXHIBITION

ABSTRACTS – GROUP 9

AUTOMOTIVE

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371624

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Automotive

Author: Dr Reuter Kay (Fraunhofer IFAM Dresden, Germany)

Co-author(s): Dr Ing Lindemann-Geipel Inge ; Mr Jin Zhengyi ; Dr Studnitzky Thomas ; Dr Andersen Olaf ; Dr Weißgärber Thomas (Fraunhofer IFAM Dresden, Germany) ; Mr Koch Raphael (Ford Werke GmbH, Germany)

Title: Additive Manufacturing Of Highly Efficient Electric Sheets Of Fe6,5Si By 3D Screen Printing

Keyword(s):
Innovative production method for electric sheets, Reduced power losses in electrical engines

Abstract:
Energy-efficient electric motors are crucial for the progress of electromobility. Soft magnetic materials with a high silicon content, such as Fe6.5Si, offer the possibility of high electrical resistance, high saturation magnetization and comparatively low power losses. However, due to the brittleness of Fe6.5Si, this material cannot be processed using conventional manufacturing methods (such as stamping). By means of 3D screen printing process, this material can be processed through a powder metallurgical processing route. Thus, electric steel sheets with low thickness, high alloying content and high productivity can be realized. We present results of printed and sintered Fe6,5Si electric steel sheets with thicknesses between 100 and 350 µm. The power loss can be reduced below 1 W kg-1 at 50 Hz and 1 T. The magnetic properties of the sheets will be discussed in dependence on the sintering parameters and the powder properties.

Innovative Aspect(s):
Innovative production method for electric sheets. Reduced power losses in electric engines.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

Notes to author: .....

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371870

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Automotive

Author: Mr Hazama Takuya (Sumitomo Electric Sintered Alloy, Ltd., Japan)

Co-author(s): Mr Takenaka Chihiro ; Mr Akiyama Yu ; Mr Uozumi Masato ; Mr Suganaga Kazuhiko (Sumitomo Electric Sintered Alloy, Ltd., Japan)

Title: Development Of Sinter Hardening Material With High Bending

Keyword(s):
Sinter hardening (SH), High bending fatigue strength

Abstract:
The use of sinter hardening material (SH material) was examined for the purpose of cost reduction by simplifying the part manufacturing process in our company, in response to the fact that many 4WD coupling cam parts adopt a sintering method that allows the cam shape to be formed with a net shape. The SH material has high hardenability, however it is not applicable for parts that require bending fatigue strength due to its low toughness. Accordingly, bending fatigue strength was improved and the required strength of the parts was successfully satisfied by achieving a mixed phase structure of martensite and austenite due to the addition of Ni to SH material.

Innovative Aspect(s):
The development has enabled the application of SH material for parts that require bending fatigue strength, which was formerly impractical.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

Notes to author: .....

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225372058

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Automotive

Author: Mr Scholzen Philipp (WZL RWTH Aachen, Germany)

Co-author(s): Dr Ing Brimmers Jens ; Prof Dr Brecher Christian (WZL RWTH Aachen, Germany)

Title: Influence Of Densification And Case Hardening On The NVH Behavior Of Sintered Gears

Keyword(s):
NVH, Gear manufacturing, Powder metallurgy, Sintered gears, Simulation, Experimental investigation, Gears, Surface densification, Case hardening

Abstract:
The powder metallurgical manufacturing of gears offers a promising opportunity in terms of reducing the noise emission and increasing the power density. Sintered gears weigh less than conventional gears and potentially have a better noise-vibration-harshness behavior, due to the remaining porosity. However, the potential of sintered gears for highly loaded applications is not fully utilized yet. Six variants of surface densified and case-hardened sintered gears from Astaloy Mo85 were tested to analyze the impact of the densification and case hardening depths on both the tooth root and flank load bearing capacities. A densification of the tooth flanks during operation was identified. The results were presented at EuroPM2021. Now, further analyses are carried out on the stress distribution in the densified tooth. Furthermore, the influence of the deformation during operation on the NVH behavior is investigated by means of transmission error and structure borne noise emission.

Innovative Aspect(s):
Characterization of the tooth flank densification during operation. Influence of the densification during operation on the NVH behavior. Stress distribution in a densified tooth.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

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WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225372193

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Automotive

Author: Dr Ing Schöffmann Wolfgang (AVL List GmbH, Austria)

Co-author(s): Dipl-Ing Knollmayr Christof (AVL List GmbH, Austria)

Title: Powertrain Development With Additive Manufactured Components -- From Prototyping To Dedicated Production Design

Keyword(s):

Abstract:
Upcoming, increasingly stringent greenhouse gas as well as emission limits demand for powertrain electrification throughout all vehicle applications. Increasing complexity of electrified powertrain architectures require an overall system approach combining modular component technology with integration and industrialization requirements when heading for further significant efficiency optimization. At the same time focus on reduced development time, product cost and minimized additional investment demand reuse of current production, machining and assembly facilities as far as possible. Up to date additive manufacturing is an established prototype component, as well as tooling technology in the powertrain development process, accelerating procurement time and cost, as well as allowing to validate a significantly increased number of variants. The production applications of optimized, dedicated AM-based component design however are still limited. Focus of the paper is on AM-based optimization of appropriate powertrain components, combining functional optimization with AM-process related production design architecture.

Innovative Aspect(s):
AM-based optimization of appropriate powertrain components, Engine as well as Fuel Cell system components, based on different materials, combining functional optimization with AM-process related production design architecture: Functional Optimization, Weight Reduction, Component Cost and Process cost reduction.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

Notes to author: .....

WORLD PM2022
CONGRESS & EXHIBITION

ABSTRACTS – GROUP 9

BIOMEDICAL

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225366905

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Biomedical

Author: Dr Ing Andersen Olaf (Fraunhofer IFAM Dresden, Germany)

Co-author(s): Dr Ing Weißgärber Thomas (Fraunhofer IFAM Dresden, Germany)

Title: Taylor-made Sintered Titanium Fiber Structures For Implant Applications

Keyword(s):
Titanium, Implant, Mechanical properties, Biocompatibility, Porous metal, Metal fiber

Abstract:
A new approach to a biomimetic orthopaedic material designed for load bearing bone is presented. It is based on strategically layered, sintered titanium fibres with anisotropic mechanical properties adjustable in three dimensions (TiFi). The matrix material is cp titanium. Parallel and cross-ply topologies at two different porosities (75 and 85 %) were manufactured and mechanically tested. In vitro and in vivo biocompatibility testing was carried out. The tests performed on the new material demonstrated anisotropic mechanical properties similar to those of natural bone, excellent osteoconductivity and, thus, excellent properties for use as an orthopaedic implant material.

Innovative Aspect(s):
New titanium fiber-based material with adjustable 3D properties. New manufacturing approach. First results of mechanical and biocompatibility testing.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

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Notes to author: .....

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225369214

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Biomedical

Author: Dr Liu Jingbo (Central South University, China)

Co-author(s): Prof Wu Hong (Central South University, China)

Title: A Biodegradable Zn-Cu-Ti-xFe Alloy For Cardiovascular Applications

Keyword(s):
Zn alloy, Microstructure, Biodegradable metal, Friction and wear, In vitro biocompatibility

Abstract:
Zinc (Zn) alloys have garnered a lot of attention in the field of biodegradable implants because of their unique biodegradability and good biological features. In this work, a new degradable Zn-2Cu-0.1Ti-xFe alloy was developed employing a novel vacuum rotary smelting technology and hot rolling process. Essentially, the hot-rolled alloy was protected against oxidation by an argon gas shields. Furthermore, microstructure evolution, mechanical characteristics, HCP-FCC phase transformation process, corrosion behaviors, cytotoxicity, and biocompatibility features were systematically evaluated. By adding trace Fe element into Zn-2Cu-0.1Ti alloy, the tensile strength and elongation was significantly improved. In particular, the elongation was more than 45%. In addition, the Fe content influences the degradation rate of the hot-rolled Zn-2Cu-0.1Ti alloy. Furthermore, the hot-rolled Zn-2Cu-0.1Ti-xFe alloy significantly increased the survival rate of SAOS-2 and HUVEC cells at varied concentrations of extracts.

Innovative Aspect(s):
Inspired from previous work, we herein develop a new method for preparing a new type of degradable Zn|Zn-2Cu-0.1Ti-xFe (x=0, 0.1, 0.3 and 0.5) biomaterials for different stent application needs, especially for cardiovascular stents. In the present work, Zn metal, Cu-38Zn alloy, Ti powder and Fe powder were used to prepare a degradable Zn alloy. The purpose of this study was to obtain a novel method (vacuum rotary melting technology) for preparing degradable Zn alloys and to study the phase transition and the microstructure evolution in different Zn alloy compositions. The effects of Fe concentration on the microstructures, tensile properties, HCP-FCC phase transformation process, corrosion behaviors, cytotoxicity, and biocompatibility properties of the as-hot-rolled Zn alloys were all studied. Furthermore, the related biodegradability mechanisms are also elucidated.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

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WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371364

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Biomedical

Author: Dr Bouvard Didier (Univ. Grenoble Alpes, France)

Co-author(s): Dr Olmos Luis (Universidad Michoacana de San Nicolas de Hidalgo, Mexico) ; Dr Jimenez Omar ; Dr Chavez Jorge (Universidad de Guadalajara, Mexico)

Title: Fabrication Of Tailored Ti-based Materials By Conventional Powder Metallurgy For Bone Implant Applications

Keyword(s):
Tailored materials, Sintering, Mechanical properties, Corrosion, Wear

Abstract:
A methodology is proposed for fabricating components with specific characteristics tuned for replacing human bones. Ti6Al4V alloy powders were used as the base material. They were mixed with metal particles as Ag, Ta or TiN and with pore formers, thus providing different features mimicking bones. As an example, we fabricated a knee bone-like component including a highly porous core in Ti6Al4V-25%Ta-5%Ag composite and a dense outer ring of Ti6Al4V|5%Ag, which resulted in relevant corrosion, antibacterial activity and osseointegration properties. Besides, a harder top surface in Ti6Al4V|15%TiN composite offered a high wear resistance. These components were fabricated by die pressing and free sintering. Their mechanical properties were close to the ones of bones and the internal porosity resulted in a permeability close to the one reported for trabecular bones. The described route involving conventional powder metallurgy processes is thus able to produce complex materials fulfilling the requirements of human bone implants.

Innovative Aspect(s):
Functional materials for biomedical applications Use of conventional powder metallurgy for fabricating complex materials Innovative methodology to obtain microstructure and properties close to the human bones High corrosion resistance under simulated biological fluids High wear resistance with low mechanical strength and stiffness.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

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WORLD PM2022
CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371800

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Biomedical

Author: Dr Emanuelli Lorena (INSTM (Operative center: University of Trento), Italy)

Co-author(s): Dipl-Ing Jam Alireza ; Dipl-Ing De Biasi Raffaele ; Prof Dr Benedetti Matteo ; Prof Dr Pellizzari Massimo (University of Trento, Italy) ; Ing Lora Carlo (SISMA SpA, Italy)

Title: Laser Powder Bed Fusion Of Innovative Beta-Ti21S Cellular Structures For Biomedical Implant

Keyword(s):
Additive manufacturing, Laser powder bed fusion, Beta titanium alloy, Cellular structures, Auxetic, TPMS

Abstract:
Development of innovative cellular structures fabricated by laser powder bed fusion (LPBF) of beta titanium alloy in the orthopedic implant fields are in continuous evolution. Recent studies highlighted the promising performances of β-Ti21S alloy, namely low elastic modulus, extraordinarily ductility and high fatigue resistance that makes it competitive with respect to Ti6Al4V. Considering cellular structures, auxetic and Triply Periodic Minimal Surface (TPMS) structures have received great interest in the recent year. Auxetic structure is interesting to achieve very low elastic modulus and TPMS to promote osseointegration. Furthermore, recent studies propose cellular structures with a porosity gradient to combine mechanical performances and bone tissue growth. In this work manufacturability of auxetic and TPMS structures in β-Ti21S alloy having 2.5 mm cell size and a porosity gradient inside the structures are investigated. Dimensional precision analysis comparing CAD with printed structures, microstructure characterization and defectiveness analysis of surface and bulk are carried out.

Innovative Aspect(s):
The aim of this work is to evaluate the manufacturability of two innovative architectural cellular structures in a novel promising β-Ti21S alloy by laser powder bed fusion (LPBF). In detail, auxetic structure, since its very low elastic modulus in the range of trabecular bone and TPMS, because of the osseointegration, are proposed. In addition, production of a porosity gradient inside both structures to achieve optimization in terms of mechanical performances and osseointegration is done. In this work, preliminary study of the printability of these structures are carried out.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

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WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371879

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Biomedical

Author: Dr Ing Poehle Georg (Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Germany)

Co-author(s): Dr Schauer Antje (Technische Universität Dresden, Germany) ; Dr Ing Redlich Christian ; Dipl-Ing Scheibler Jakob ; Dr Ing Weissgaerber Thomas ; Dr Ing Quadbeck Peter (Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Germany)

Title: Biodegradation And Biocompatibility Of Molybdenum As An Implant Material

Keyword(s):
Molybdenum, Bioresorbable metallic materials, Medical implants, Screen printing, In vivo study, Biocompatibility

Abstract:
Biodegradable metals have entered the implant market in recent years, but still do not show fully satisfactory degradation behaviour and mechanical properties. In contrast, it has been shown that pure molybdenum has an excellent combination of the required properties in this respect. We report on PM based screen printing of thin-walled molybdenum tubes as a processing step for medical stent manufacture. We also present data on the in vivo degradation and biocompatibility of molybdenum. The degradation of molybdenum wires implanted in the aorta of rats was evaluated by SEM and EDX. Biocompatibility was assessed by histological investigation of organs and analysis of molybdenum levels in tissue extracts and body fluids. Degradation rates of up to 13.5 µm|y were observed after 12 months. No histological changes or elevated molybdenum levels in organ tissues were observed. In summary, the results further underline that molybdenum is a highly promising biodegradable metallic material.

Innovative Aspect(s):
While excellent mechanical strength, suitable degradation behaviour and biocompatibility of molybdenum have been demonstrated in vitro for molybdenum, the presented results reveal data from one of the first in vivo studies of this new and promising bioresorbable metallic material. It is shown that a moderate degradation rate and highly predictable degradation characteristics also occur in vivo, while no pathological changes or molybdenum accumulation are detectable in organ tissues. Furthermore, advances in the PM based manufacture of molybdenum for processing into medical stents are reported.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

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WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225368195

Requested paper type: Poster Presentation

Topic: Applications / **Subtopic:** Biomedical

Author: Mr Janzen Kevin (Fraunhofer IAPT, Germany)

Co-author(s): Mrs Groß Patricia ; Dr Ing Imgrund Philipp (Fraunhofer IAPT, Germany) ; Prof Dr Emmelmann Claus (Institute of Laser and System Technologies iLAS, Hamburg University of Technology TUHH, Germany)

Title: Potentials Of Metal Binder Jetting For Endoprosthetics

Keyword(s):

Abstract:
Additive manufacturing (AM) of metal components offers enormous potential for patient-specific medical applications. Endoprostheses such as artificial hip joints are already being successfully manufactured using the laser or electron powder bed fusion (L-|E-PBF) process. Recently, however, new sinter-based AM processes have increasingly come into focus. Metal binder jetting (MBJ) promises lower manufacturing costs with the same or higher geometrical freedom and accuracy as L- or E-PBF. Nevertheless, concrete industrial application examples are still pending. In this paper, a possible process chain for the MBJ production of Ti-6Al-4V using the example of acetabular cups is therefore presented and investigated. For this purpose, requirements for the mechanical and chemical properties are compiled, costs and cost structure as well as data preparation are investigated.

Innovative Aspect(s):
Endoprostheses manufactured in sinter-based AM processes are not state of the art. The paper is intended to show possibilities and to provide information and initial values for future projects in this field in order to manufacture medical components using the metal binder jetting process.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

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WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225370564

Requested paper type: Poster Presentation

Topic: Applications / **Subtopic:** Biomedical

Author: Dr Liu Yijun (The Manufacturing Technology Centre, United Kingdom)

Co-author(s): Dr Triantaphyllou Andrew (The Manufacturing Technology Centre, United Kingdom) ; Dr Eustice David ; Dr Ireson Robert ; Dr Holcroft Chris ; Dr Glendenning Malcolm (Glass Technology Services Ltd, United Kingdom)

Title: Metal|glass Interface Characterisation Of A Multiscale Bioactive Surface Structure On Ti-6Al-4V Alloy With Laser DED Process

Keyword(s):
Laser cladding, Bioactive glass, Crystallisation, Additive manufacturing

Abstract:
The present study demonstrates the feasibility to fabricate a multiscale bioactive surface structure onto a biomedical grade Ti-6Al-4V alloy substrate using a multi-material blown powder laser direct energy deposition process (DED). The multiscale surface structure consisted of two layers: a Ti-6Al-4V transition layer with a customised structure, deposited onto a Ti-6Al-4V alloy substrate, followed by a layer of customised bioactive glass cladded on top. It is possible to create a transition layer with physical interlocking features that are fully bonded with the bioactive glass for enhancement of the metal-glass adhesion. The metal|glass interface was characterised in terms of metallurgical reactions and mechanical properties. Indentation tests confirmed excellent cohesion of the metal-glass interface. The microhardness of the bioactive glass near the interface varied from 5.44 to 7.78 GPa. Fracture toughness of the cladded glass was estimated in the range of 1.40-3.91 MPa m1|2.

Innovative Aspect(s):
In order to create a rigid and permanent fixation between the titanium medical implant and the native bone or host tissue, surface treatment of the implant is essential. There are extensive studies on various surface treatment techniques in the past. More recently, laser DED process has been investigated and found to be a promising process to deposit bioactive glass on an implant surface. However, there is a lack of research on creating a multiscale surface structure with bioactive properties to more effectively generate a strong cohesion bonding between the metal substrate and the bioactive deposit.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

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WORLD PM2022
CONGRESS & EXHIBITION

ABSTRACTS – GROUP 9

ENERGY

WORLD PM2022
CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225370544

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Energy

Author: Dr Romero Carlos (Universidad Carlos III de Madrid, Spain)

Co-author(s): Mr Benedetto Davide ; Prof Gordo Elena (Universidad Carlos III de Madrid, Spain)

Title: Feasibility Of Titanium-based Materials For PEMFC Bipolar Plates Using Powder Metallurgy And Surface Modification Approaches

Keyword(s):
Titanium, Surface modification, Fuel cells, Bipolar plates

Abstract:
Bipolar plate (BP) materials and designs are critical for the performance of a PEMFC and a PEMEC due to their role as reactant and product distributor and electron transporter between cells. With the goal of increasing the power density of the PEMFC stacks, especially for transportation, the weight of the bipolar plate is also an important parameter. Titanium is a material that is a promising alternative to stainless-steel to manufacture light, metallic-based BP if some of its challenges are addressed, one of them being the passivation of its surface during operation, that creates ohmic losses. The aim of this work is to assess the use of powder metallurgy to manufacture titanium-based bipolar plates with the ability to obtain alternative designs for the flow field and the use of suitable surface modification techniques that can improve the performance.

Innovative Aspect(s):
Alternative surface modification methods that improve the performance of Ti for bipolar plates.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

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WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225370593

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Energy

Author: Dr Brant de Campos Jose (Rio de Janeiro State University, Brazil)

Co-author(s): Dr Dias Senra Jaqueline ; Ing Quizunda Adilson Claudio (Rio de Janeiro State University, Brazil) ; Dr Sampaio Aguilar Marilza (UNESA, Brazil)

Title: Synthesis and characterization of nanostructured Hydroxyapatite with the use of porogenic agent for applications as catalyst in the production of biofuels

Keyword(s):
Hydroxyapatite, Nanometric, Sucrose, Catalyst, Ethanol, n-butanol

Abstract:
Hydroxyapatite (HAP) has been one of the most researched ceramic materials for application in bone implants and as a catalyst system. In this context, HAP has been used as a material system for ethanol conversion, like for n-butanol and for Butadiene. In this context, the present work aims to carry out a conversion reaction using the HAP obtained from hen skin with sucrose as a porogenic agent and ethanol as the catalytic system. The conversion reactions will take place at a temperature of 300 °C at rest and it will be conducted in a 30 mL steel alloy autoclave. The autoclave will be sealed and placed in a preheated oven at 240 °C, with different reaction times, weight and temperature, as experimental variables. The reaction products will be evaluated by chromatography, BET, SEM and XRD techniques and it is expected that its behavior would reach a high reaction yield.

Innovative Aspect(s):
This work presents the use of a nanostructured ceramic material synthetized from a natural source (hen skin egg) as a catalyst system for ethanol conversion. The particle size and the surface porosit are controled by a porogenic agent. The catalyst efficiency will be evaluated in a autoclave reactor.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

Notes to author: .....

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371743

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Energy

Author: Dipl-Ing Walther Gunnar (Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Branch Lab Dresden, Germany)

Co-author(s): Dipl-Ing Büttner Tilo ; Dr Ing Rauscher Thomas ; Dr Bernäcker Christian Imanuel ; Dr Röntzsch Lars ; Dipl-Ing Weißgärber Thomas (Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Branch Lab Dresden, Germany) ; Mr Bae JungSuk (

Title: Applications Of Metal Foam In Catalysis And Electrolysis

Keyword(s):
Metal foam, Catalyst, Powder metallurgy, Heterogeneous catalysis, Electrolysis

Abstract:
Open cell metallic foams are suitable for a wide range of applications as materials for filters, catalyst supports for heterogeneous catalysis and electrodes in batteries, fuel cells and electrolyzers due to their excellent heat and mass transfer, low pressure drop, good electrical conductivity and high chemical resistance. The foam can be produced in a wide range of pure metals like nickel, iron, silver and copper. Depending on the application, high high-temperature, oxidation and corrosion resistance can be achieved by a patented powder metallurgical alloying process in industrial scale. In the current paper, results for applications of NiFeCrAl foam as catalyst for Steam Methane Reforming and silver foam for the formaldehyde synthesis are discussed. Another focus is on the application as electrode material in electrolysis. Electrochemical investigations show that modified nickel foam exhibit a much lower overvoltage than nickel sheets and thus the operating costs of electrolyzers can be significantly reduced.

Innovative Aspect(s):
The innovative foam production technology is up-scaled in industrial scale which is a precondition for a break through to applications. design flexibility in shape and size. high geometric surface area. exceptional mixing ability of the reactants. good handling for quick cat loading | unloading. better heat transfer compared to ceramic catalyst carriers à lower heating temperature of rector tubes necessary à longer life time of the reactors and lower energy consumption. lower overvoltage compared to nickel sheet material and thus the operating costs of electrolyzers can be significantly reduced.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

Notes to author: .....

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371861

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Energy

Author: Mrs Monterde Mari Carmen (AMES PM Tech, Spain)

Co-author(s): Dr Calero Jose Antonio (AMES PM Tech, Spain) ; Dr Torrell Marc ; Dr Bernadet Lucile (IREC, Catalonia Institute for Energy Research, Spain) ; Dr Jimenez-Piqué Emilio (UPC (Universitat Politécnica de Catalunya), Spain)

Title: Novel interconnects manufactured by powder metallurgy for solid oxide cells applications

Keyword(s):
Solid oxide cells, Metallic interconnect, Hydrogen technologies, Fuel cells, Oxidation resistance, Ferritic stain steel

Abstract:
This work presents the study and development of SOC interconnects produced by PM. In this work, FSS and modified-FSS with Y2O3, which aims to extend the durability of the material, have been studied as interconnect materials for SOC tested under relevant operation conditions. Chemical composition effect and chromium content on the CET, the oxidation kinetics and the area specific resistance (ASR) were studied and discussed. In this regards, thermogravimetric analysis during 3500h at 800°C under oxidizing atmosphere are also presented and discussed. Moreover,ASR values below 2.2mΩ.cm2 and 7.7mΩ.cm2 were respectively obtained for FSS and modified-FSS interconnects, when measured at 770°C in Air|90N2-10H2 for more than 500h.The use of conventional MnCo spinel chromium-getter coatings have also been studied obtaining ASR values of 7.4mΩ.cm2 at 770°C in Air| 90N2-10H2 during 250h. The obtained results indicated that FSS based interconnect, manufactured by PM, is a potencial alternative to be considered.

Innovative Aspect(s):
New market for PM. PM component for energy market. Essential component in SOC systems for electricity (SOFC fuel cell) or hydrogen (SOEC electrolyser) technologies. ASR and oxidation rate values of the same order as interconnects made by stamping. Limitation of grain size growth by addition of Y2O3 to the blend. Functional coating as chromium barrier layer.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

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WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225371872

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Energy

Author: Dr Ing Geneves Thomas (FRAMATOME, France)

Co-author(s): Ms Ayrault Muriel (FRAMATOME, France) ; Dr Ing Shen Yang ; Dr Ing Odinot Julie (EDF, France) ; Mr Gonzales Daniel (BODYCOTE, Sweden)

Title: Manufacturing Of A Nuclear Reactor Primary Component By PM + HIP

Keyword(s):
Nuclear, Stainless Steel, 304L, PM-HIP

Abstract:
The elaboration of Nuclear Power Plant primary circuit pipework currently relies on forging|casting and machining processes. However, to maintain performance and competitiveness, Framatome and EDF decided to take advantage of Powder Metallurgy Hot Isostatic Pressing (PM+HIP) benefits and launched a pre-industrialization project. It is intended to demonstrate the ability of the supply-chain to produce an 8 tons 304L primary elbow in compliance with the nuclear requirements and to address the corresponding documentation. The manufacturing of the elbow was entrusted to Bodycote, which has recognized expertise in this area. The presentation will go over the fabrication of this large component and will then provide characterization results confirming the compliance with EDF|Framatome's requirements.

Innovative Aspect(s):
The innovative aspects of this study rely in the two following points: Production of a massive component with controlled deformations. Validation of 304L properties. Compliance with the stringent requirements of the nuclear domain.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

Notes to author: .....

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225372071

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Energy

Author: Prof Missiaen Jean-Michel (Université de Grenoble Alpes, France)

Co-author(s): Ing Botter Nicolas ; Dr Khazaka Rabih (Safran SA, France) ; Prof Bouvard Didier ; Dr Avenas Yvan (Université Grenoble Alpes, France)

Title: Aging Of Sintered Ag Tracks And Die Attach Layers For Power Electronics Modules

Keyword(s):
Aging, Coarsening, Joining, Power electronics, Sintering

Abstract:
An assembly for power electronics based on the deposition and pressureless sintering of successive silver layers on an Aluminum Nitride heat sink has been developed. Sintered silver layers act as die attach, current tracks and adhesion layer on the ceramic. This assembly has the advantage to give sintered joints with a high mechanical strength and a high thermal conductivity compared to standard brazing alloys at the highest operating temperature of semiconductor components (200°C). In this paper, aging of the silver tracks and die attach layers is studied. A significant coarsening of the microstructure is observed in confined areas, under the chip and|or far from the external surface, after 200h annealing in air at 200°C, whereas coarsening is essentially inhibited in argon atmosphere. The shear strength and thermal properties of the sintered joint are improved after thermal storage in air. Mechanisms of the microstructural evolution and microstructure-properties relationships are discussed.

Innovative Aspect(s):
Low temperature microstructural coarsening of sintered silver joints. Improvement of mechanical and thermal properties during low temperature aging of sintered silver joints.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

Notes to author: .....

WORLD PM2022 CONGRESS & EXHIBITION
09-13 OCTOBER

Paper number: WP225372167

Requested paper type: Oral Presentation

Topic: Applications / **Subtopic:** Energy

Author: Dr Ing Heubner Felix (Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Branch Lab Dresden, Germany)

Co-author(s): Dr Röntzsch Lars ; Dr Ing Weißgärber Thomas (Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Branch Lab Dresden, Germany)

Title: Solid Hydrogen Carriers: Metal Hydride Technology For Hydrogen Storage Applications

Keyword(s):
Metal hydrides, Graphite, Composite materials, Neutron imaging, Hydrogen

Abstract:
To slow down climate change fossil fuels must be replaced quickly. Hydrogen will play a key role in the success of this energy transition, since it is well suited as a chemical energy carrier and fuel. Today, hydrogen is stored in high pressure vessels or in low temperature liquid storage units. In contrast, solid hydrogen carriers are promising materials that enable low-pressure and safe hydrogen storage solutions. Solid hydrogen carriers are e.g. metal hydrides formed from a host metal (Mg) or intermetallic alloy (TiMn, FeTi) with hydrogen in an exothermal reaction. In this contribution, advanced metal hydride composite materials, which consist of metal hydride-forming alloy powder but also shape-stabilizing and highly heat-conductive second phases (graphites, polymers, etc.) are discussed from a material and manufacturing perspective. The extent to which metal-hydride composite materials can remain shape-stable and therefore age-resistant is shown, which paves the way for use in industrial scale.

Innovative Aspect(s):
Metal hydrides offer highest volumetric hydrogen storage densities by up to 150 g H2|l. The storage properties like desorption gas pressure and temperature of intermetallic hydride forming alloys can be tuned by changing alloy composition. Brittle intermetallic alloys decrepitate during hydrogen absorption and desorption. The volume swelling during cycling was characterized using neutron imaging. Neutron radiograph sequences will be presented to visualize this process. Metal hydride composite materials were developed to transport the heat of reaction from the material bed to the outer surface of the pressure vessel. Again, neutron radiograph sequences will be presented to visualize hydrogenation fronts inside composite materials on a µm to mm scale. Volume swelling and shrinking was characterized. Integrating this information into storage vessel design will increase the overall storage density and the dynamics of hydride based hydrogen storage systems.

TPC Reviewer name: .....

Keynote ☐ Oral ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason: .....

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