EURO PM2023
CONGRESS & EXHIBITION

Technical Programme Committee
15th February 2023

ABSTRACTS BOOK – GROUP 8

TOOLS FOR IMPROVING PM

EPMA
european powder metallurgy association

EURO PM2023
CONGRESS & EXHIBITION

Technical Programme Committee
15th February 2023

TOOLS FOR IMPROVING PM

TEST AND EVALUATION

EPMA
european powder metallurgy association

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235755779

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Test and Evaluation

Author : Prof Dr Danninger Herbert (Technische Universität Wien, Austria)

Co-author(s) : Dr Marschnigg Stefan, Dr Herzig Christopher, Prof Dr Gierl-Mayer Christian, Prof Dr Limbeck Andreas (Technische Universität Wien, Austria), Dr Weirather Thomas (CERATIZIT Austria GmbH, Austria), Dipl-Ing Granzer Thomas (Plansee Composite Materials GmbH, Germany)

Title : Analysis Of The Binder Element Content In The W Phase Of Tungsten Heavy Alloys

Keyword(s) :
Tungsten Heavy Alloys; Tungsten Phase; Solubility; Nickel; Iron; Laser Ablation ICP-MS

Abstract :
Tungsten heavy alloys are liquid phase sintered two-phase materials in which tungsten grains are embedded in an austenitic base matrix. While the solubility of W in the binder phase is high both at sintering temperature, when the binder phase is liquid, and also after cooling, the solubility of the binder elements in the W phase is very low. However, the exact content has been a matter of discussion for a long time. In the present study, laser ablation induction coupled plasma mass spectrometry (LA-ICP-MS) has been employed for analyzing the Ni and Fe content in the W phase of W-Ni-Fe heavy alloys, using specifically prepared low-binder specimens for calibration. It showed that the binder element content is in fact significantly lower than presented in the literature, LA-ICP-MS yielding contents of approx. 340 µg|g for Fe and 60 µg|g for Ni.

Innovative Aspect(s) :
The high ductility of W heavy alloys depends in part on the ductility of the W grains in the microstructure which in turn depends on the purity of the W, in particlular on the content of binder elements. Published data for this content are scarce and questionable. In the present work, an innovative analytical method was employed that enables analysis also in the ppm range.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235761326

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Test and Evaluation

Author : Mr Pruesse Philipp (Dimensionics Density GmbH, Germany)

Co-author(s) : Dr Ing Krueger Hendrik, Dipl-Ing Kostbade Robert, Mr Evers Mathias (Dimensionics GmbH, Germany), Dipl-Ing Walcher Hartmut (ARBURG GmbH + Co KG, Germany)

Title : Automated Archimedes Density Measurement Of Green And Sintered Parts For Process Parameter Improvement In MIM And CIM Production

Keyword(s) :
Density; Injection Molding Process; CIM; MIM; Green Density; Green Body; Process Automation; Process Parameter Improvement; Cost-Efficiency; Saving Resources

Abstract :
In powder injection molding processes, every new batch of feedstock or tool change, especially when starting production with a new tool, requires an iterative adaption process of machine parameters to find the proper setup to yield parts with the correct green density. The decisive factor for the quality of injection molding components is the constant density distribution over the whole green part. Uneven distribution causes uneven shrinkage behavior, which leads to warped dimensionally unstable pieces.The study is a cooperation of Dimensionis Density GmbH and ARBURG. Through very accurate green density measurements provided by the platform for automated density measurement of Dimensioinics, the green density of injection molding parts can be analyzed in much more detail. The study shows how the material behaves after being injected into the mold under different conditions and casts a new light on the influence of varying process parameters on the green density of parts.

Innovative Aspect(s) :
The new machine platform allows automated density measurements independent of the part condition (green or sintered part). This innovative process was developed by Dimensionics Density and marks a milestone in the advancement of density measurement for solids.The study's findings made a new understanding of the distribution of density across the part within the mold possible. The results imply that measuring the green density of injection molding parts as part of the process holds a new level of process knowledge and control. Thanks to the highly accurate density measurements, the shrinkage of green parts in the sinter ovens can be predicted very precisely. This allows an early intervention before a part enters the energy-intensive sintering oven.Finally, new ways of computer-aided quality assurance and further process automation are enabled, which helps companies to reduce scrap and defective parts and improve process reliability.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023 CONGRESS & EXHIBITION

01-04 October 2023

Paper Number : EP235763648

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Test and Evaluation

Author : Dr Ing Ciuffini Andrea Francesco (ESRF, France)

Co-author(s) :

Title : Latest Advances In Powder Metallurgy Characterization At European Synchrotron Radiation Facility (ESRF)

Keyword(s) :
Additive Manufacturing; Synchrotron XRD; Synchrotron X-ray Tomography; Residual Stresses; Morphological Characterization; Alloy Design; Solidification

Abstract :
In 2021 was completed the upgrade of the European Synchrotron Radiation Facility ESRF – EBS (Extremely Brilliant Source), becoming the first new generation of high-energy synchrotron, increasing brilliance and coherence of X-ray beams by a factor of 100 compared to present-day light sources. The highlights of the research activities in powder metallurgy made in these 2 years would be presented:The stress relief given by heat treatment on the residual stresses of an additive manufactured 316L stainless steel arch structure (part of EU-funded EASI-STRESS project);Synchrotron μ-tomographic morphological description of additively manufactured open porous structures made by Laser-based Powder Bed Fusion (L-PBF), to characterize attached spherical particles on the surface of functional structures;Study of the solidification of a new Al-4Mn-3Ni-2Cu-1Zr alloy, designed for L-PBF, developing a new strategy for alloy design in high-strength aluminum alloys for powder metallurgy.

Innovative Aspect(s) :
The use of synchrotron light source for measurements is yet an innovative aspect since it provides X-rays much brighter than the X-rays used in common instrumentation. This may be exploited in may useful way for powder metallurgy applications.In stress measurements, achieving higher precision and measurements depth.In morphological measurements, synchrotron-based μCT is drastically reducing scan times and at the same time improving image quality as compared to laboratory-based μCT tools. This is because of the high photon flux and the high coherence of X-rays generated by synchrotrons.In microstructure measurements, X-ray synchrotron nano-tomography allowing to finely characterize the microstructure in 3D, revealing crucial information on the microstructure inherited by fabrication path.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235764060

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Test and Evaluation

Author : Dr Gatões Daniel (University of Coimbra, Portugal)

Co-author(s) : Mr Cacho Luís, Dr Vieira Teresa (University of Coimbra, Portugal)

Title : MCT Non-destructive Testing Of Additively Manufactured 3Dobjects As Support For True Sustainability

Keyword(s) :

Abstract :
Additive Manufacturing is an essential process for novel geometries. However, complex parts demand a new perspective in defect control and support to the modelling of mechanical behaviour in order to assess the applicability of the 3Dobject to the service conditions. Therefore, non-destructive testing is essential for the evaluation of the role of stochastic defects (size, shape and homogeneity distribution) on the mechanical properties of AM objects. In this study, a wide evaluation of µCT (micro-computed tomography) for two metallic additive manufacturing processes – powder bed fusion (direct) and material extrusion (indirect) – is performed. The results are analysed in terms of the physical changes that occur in additive manufacturing per defect origin type. Comparison of mechanical properties with the results of modelling, having in mind the defect characteristics, led to conclude that µCT is a powerful tool for AM parameter optimisation and for the improvement of process sustainability.

Innovative Aspect(s) :

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235764573

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Test and Evaluation

Author : Dipl-Ing Parareda Sergi (Eurecat, Spain)

Co-author(s) : Dr Casellas Daniel, Dipl-Ing Bemani Milad (Eurecat, Spain), Dr Mateo Antonio (UPC, Spain), Dr Molotnikov Andrey, Dr Das Raj (RMIT, Australia)

Title : A Fast Method To Evaluate The Fatigue Resistance Of Additive Manufacturing Metal Specimens

Keyword(s) :
Fatigue Resistance

Abstract :
The evaluation of fatigue resistance requires expensive and time-consuming tests, which often limits the generation of data for different material and processing conditions. This is especially relevant when characterising specimens built by additive manufacturing (AM), because the fatigue resistance is influenced by many processing parameter and the inherent anisotropic behavior of many AM techniques. So, accelerated or more straightforward testing procedures would help to further progress in microstructural development of fatigue optimised AM parts.This work shows the application of a method based on damage mechanics to the evaluation of the fatigue resistance of a Ti6Al4V alloy manufactured by SLM. The obtained fatigue limit shows a good agreement with the results from a conventional fatigue method, i.e., the stair-case. Then, the method allows to quickly evaluate the effect of process parameters on fatigue strength and would permit to optimize the design of fatigue dimensioned parts produced by AM.

Innovative Aspect(s) :
Some methods have been developed to reduce the testing time, by accelerating the application of the cyclic loads or by measuring the evaluation of material properties through thermography or following damage mechanics. Recently, the method based on damage mechanics has been successfully applied to obtain the fatigue limit in a wide range of steel and aluminium alloys. It gives a good estimation of the fatigue limit in less than one day using a conventional universal testing machine and digital image correlation techniques, which is much faster than conventional fatigue testing methods. This work shows the application of such method to the evaluation of the fatigue resistance of a Ti6Al4V alloy manufactured by SLM. The presented the method allows to quickly evaluate the effect of process parameters on fatigue strength and would permit to optimize the design of fatigue dimensioned parts produced by AM.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023 CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235765014

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Test and Evaluation

Author : Dr Duffy Violeta (Malvern Panalytical, Netherlands)

Co-author(s) : Dr Duffy John (Malvern Panalytical, United Kingdom)

Title : Detecting Contaminants In Metal Powders Using X-ray Fluorescence

Keyword(s) :

Abstract :
Contamination of metal powders used for additive manufacturing provides a significant risk to product quality and safety. That's because the presence of contaminant particles with different melting characteristics or mechanical properties than the bulk powder can lead to localized stress points in the printed part. This could lead to premature or catastrophic failure and is especially important in risk adverse sectors such as aerospace, medical, and oil and gas. Contamination can originate at various stages in the value chain, including powder production, powder handling, and powder recycling at the AM facility. Identifying contamination can be difficult though as we are often dealing with ppm levels of contaminant, and in the case of cross-contamination with other AM powders they can look visibly similar. In this talk we show the potential of X-ray fluorescence as a tool for identifying inorganic and metallic contaminants in metal powders down to ppm level.

Innovative Aspect(s) :
As far as we are aware noboby has come up with a prefered for solution for detecting contaminants in metal powders for AM and nobody has explored the potential of XRF in this regard. We will show how can be a quick aand easy method for detecting certain inorganic contaminants.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235765170

Requested presentation type : Poster Presentation

Topic : Tools for improving PM **Subtopic :** Test and Evaluation

Author : Mr Just Marvin (CERATIZIT Luxembourg S.à r.l., Luxembourg)

Co-author(s) : Dr Useldinger Ralph (CERATIZIT Luxembourg S.à r.l., Luxembourg), Dr Baller Jörg, Mr Medina Peschiutta Alexander (University of Luxembourg, Luxembourg)

Title : Maximum In Mass Flow Rates Of Hard Metal Granules Through Circular Orifices In Relation To The Angle Of Repose

Keyword(s) :
Mass Flow Rate; Beverloo Law; Granular Material; Angle of Repose

Abstract :
The mass flow of granular matter through orifices can be described by the well-known Beverloo law. It depends on particle and orifice sizes, interparticle and particle|container interaction forces, particles' surfaces - to name a few influences on the mass flow rate. We present an experimental study of the flow of a set of ready-to-press (RTP) hard metal powders through orifices of varying diameter. The obtained parameters of the Beverloo law are compared with angle of repose measurements. The interplay between attractive interparticle forces and gravitational forces are discussed for both types of experimental measurements and related to the difference between particle and orifice size.

Innovative Aspect(s) :
The presented study systematically relates angle of repose measurements to mass flow rates through orifices for ready-to-press hard metal powders. It contributes to the knowledge of the flow behaviour of this class of materials.

Reviewer's name : ……

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : ……

Notes to author : ……

……...

EURO PM2023
CONGRESS & EXHIBITION

Technical Programme Committee
15th February 2023

TOOLS FOR IMPROVING PM

SECONDARY OPERATIONS

EPMA
european powder metallurgy association

EURO PM2023 CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235755706

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Secondary Operations

Author : Dr Vattur Sundaram Maheswaran (Höganäs AB, Sweden)

Co-author(s) : Dr Andersson Michael (Höganäs AB, Sweden)

Title : Tailored PM Steel Materials For Heat Treatment Using A Simulation Tool To Predict The Hardenability

Keyword(s) :
Heat Treatment; Simulations; Hardenability; PM Steels

Abstract :
The performance of PM steels is directly related to the material properties which is a consequence of the input alloying addition and processes involved. However, it is of significance to understand the hardenability requirements, specific to the component size|dimensions and the selected material for the specific heat treatment (HT) processes where gas and oil are used for quenching. Processes such as sinter-hardening, case-hardening, and through-hardening are commonly performed to enhance the performances. In this work, quenching simulations were performed and a tool for hardenability calculation is developed with respect to the materials, components size, and different quenching mediums. For the given component dimensions, this tool predicts the suitable material and the cooling rate required to transform the microstructure into fully martensitic using FEM. Eventually, this allows for the minimising the number of trials required for optimising the HT process for PM steels.

Innovative Aspect(s) :
In order to optimise a heat treatment for the PM steels, practically it requires several heat treamtent trials for each and individual material and components, which results in the longer process development time and additional resources.For the given PM steel component with the specific size and the dimensions, using FEM the hardenability can be predicated at the different regions, allowing for tailored material and the process selection.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235762567

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Secondary Operations

Author : Mr Iss Valérian (IWM RWTH Aachen, Germany)

Co-author(s) : Mr Ulferts Alexander (Inductoheat Europe, Germany), Mr Rajaei Ali, Prof Dr Broeckmann Christoph (IWM RWTH Aachen, Germany)

Title : Development Of A Robust And Reliable Induction Surface Hardening Process For Sintered Steel Components

Keyword(s) :
Heat-Treatment; Induction Hardening; Sintered Gears

Abstract :
Induction hardening enables to control the properties of the surface layer of components through suitable process parameters. This heat-treatment is characterized by short process times, low energy costs, high reproducibility and low distortion levels. With sintered steels, however, the risk of cracking in induction hardened components is high due to low thermal conductivity, reduced ductility and high residual stresses. Large scale deployment of induction hardening for sintered steel components requires deeper understanding of the relationships between material and process parameters. In this work, the relevant material data, such as the phase transformation behavior of different alloys, is determined. Induction hardening tests on components made of sintered steels are carried out with systematic variation of both material properties (carbon concentration, porosity) and process conditions (heating, quenching and tempering parameters), in order to link these interacting parameters with the resulting microstructure, hardness, residual stresses and susceptibility to cracking.

Innovative Aspect(s) :
A systematic investigation of the influencing parameters of induction hardening heat-treatment of components made of sintered steels had not been conducted so far. The results may deliver enhanced knowledge about the relationships between the material and process conditions and the metallographic and mechanical properties of inductive surface-hardened parts. This represents a major step towards optimized induction heat-treatment processes for sintered steels.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235764667

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Secondary Operations

Author : Dr Colaneri Alessandro (RINA Consulting Centro Sviluppo Materiali Spa, Italy)

Co-author(s) : Dr El Sayed Yasin Mohamed, Dr Fransesini Leonardo, Dr Lionetti Stefano (RINA Consulting Centro Sviluppo Materiali Spa, Italy), Dr Romeo Paolo, Dr Pispola Giulio, Dr Burattini Claudia (Umbragroup Spa, Italy)

Title : Surface Roughness Modification Methods For AM Heat Exchangers Applications

Keyword(s) :
Additive Manufacturing; Surface Finishing; Post Treatments

Abstract :
The effect of surface roughness on heat transfer capacity is still an active research area in the sector of heat exchanger manufacturing because AM allows to design complex and articulated geometries directly with cooling channels. Management of roughness is important because on one hand it has been demonstrated that a rough surface can increase the heat exchange, when this value is comparable to the height of the laminar layer, and on the other hand increasing surface roughness increase pressure drop which can reduce the performance of the heat exchanger. The possibility to apply surface treatment methods to internal cooling channels of different dimensions in AlSi7Mg components obtained through SLM technology is studied. The application of tumbling and electropolishing is evaluated through an experimental campaign. Different tumbling and electropolishing conditions are applied with the aim of evaluating the penetration effect of the treatment into the channels of the component.

Innovative Aspect(s) :
The paper presents results of the experimental test on laboratory scale of cheap and fast technique to control surface roughness.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023 CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235765571

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Secondary Operations

Author : Dr Mellin Pelle (Swerim AB, Sweden)

Co-author(s) : Dr Heino Stefan (Swerim AB, Sweden), Mr Shipley James, Mr Magnusson Anders (Quintus Technologies AB, Sweden), Dr Forsberg Fredrik (Luleå University of Technology, Sweden), Mr Forsgren Björn, Mr Waernqvist Per (Ringhals AB, Sweden)

Title : XCT-Tracking Pore Size Development, In L-PBF Built 316L, During HIP And Subsequent Heat Treatments

Keyword(s) :
L-PBF; Porosity; Regrowth; HIP; 316L

Abstract :
Understanding the shrinking and regrowing porosity in 316L is the purpose of this work. Pores always shrink during Hot Isostatic Pressing (HIP), which is a technique for defect-healing of materials after L-PBF, sintering, casting etc. X-ray computer tomography (XCT) is here used to track the size of individual pores, as they shrink during HIP, and regrow at high temperature. The pores regrow since they are Ar-filled and pressurized, as result of L-PBF (under Ar) and HIP. However, in light of the obtained results, the regrowth is predictable and largely a function of original pore volume and temperature which the material is exposed to. These two parameters determines the internal pressure of the pore, which must be suffciently high for expansion to occur. A post-weld heat treatment at 680 °C, resulted in no regrowth regardless of size. Only heat treatments at high temperature resulted in regrowth of the largest pores.

Innovative Aspect(s) :
This work tracks individual pores and gives a solid understanding of the link between original pore size, internal pressure (depending on temperature) and regrowth.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023 CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235765766

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Secondary Operations

Author : Mr Beamer Chad (Quintus Technologies LLC, USA)

Co-author(s) :

Title : Development Of Clean Hot Isostatic Pressing (HIP) Processing

Keyword(s) :
HIP; Surface Oxidation; Heat Treatment; Getters

Abstract :
HIP has often been coupled with oxidation of part surfaces. Oxygen originating from several different individual sources, all which must be controlled to avoid surface oxidation and various forms of contamination. This has led to the need to wrap components with different types of metal foils gettering the contaminants before these can react with the part surfaces. The need for getters of course consumes resources placing a demand to develop a viable solution to this challenge.Quintus Technologies has now developed a new toolbox under the High-Pressure Heat Treatment umbrella called Quintus Purus®, a combination of best practices in way of working with the HIP system, new equipment capabilities and fit for purpose oxygen getter cassettes. This concept promises the opportunity to reduce oxygen species in the HIP process by over 95%. The result is a path for significantly less part surface oxidation and contamination.

Innovative Aspect(s) :
Quintus Technologies has developed a new capability for HIP|High Pressure Heat Treatment equipment with the purpose to make it possible to avoid extensive surface oxidation of high oxygen affinity materials when densified and heat treated in Compact HIP equipment and in the new generation of furnaces. An added benefit is that the heater materials degrade at a lower rate, increasing system total lifetime and cost of operation.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION

Technical Programme Committee
15th February 2023

TOOLS FOR IMPROVING PM

OTHER TOOLS FOR IMPROVING PM

EPMA
european powder metallurgy association

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235762617

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Other tools for improving PM

Author : Dr Momeni Mohammad (European Patent Office, Netherlands)

Co-author(s) : Dr Gimeno-Fabra Lluis (European Patent Office, Netherlands), Prof Danninger Herbert (Technische Universität Wien, Austria)

Title : Ferrous Powders & Sintered Steels; An Overview Of Granted Patents At The European Patent Office From 2015 To 2020

Keyword(s) :
Intellectual Properties; Patents; European Patent Office; Ferrous Powders; Sintered Steels

Abstract :
Patents provide a solid legal framework for inventors to fairly benefit from their contribution to technology. The social deal around patents, requires a clear and sufficient disclosure of novel and inventive subject-matter. This means that patents contain precious information on the most advanced state of innovation worldwide. Consequently, providing an overview of the granted patents seems to be crucial to know the industrial trends. In this presentation, the public data is decoded and presented in granted patents at European Patent Office (EPO) from 2015 to 2020 to sketch this evolution and show the major industrial trends, wherein their opposition periods have expired. The scope of the presentation is revealing the latest industrial developments and growing technology developments in manufacturing of ferrous powders & sintered steels.

Innovative Aspect(s) :
Providing an overview of the granted patents at European Patent Office (EPO) from 2015 to 2020 to know the industrial trend in manufacturing of ferrous powders & sintered steels.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023
CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235764023

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Other tools for improving PM

Author : Ing Berger Aaron (Ruhr-University Bochum, Germany)

Co-author(s) : Ing Ziesing Ulf, Dr Ing Benito Santiago, Prof Dr Weber Sebastian (Ruhr-University Bochum, Germany)

Title : A New Experimental Investigation Of The High-Temperature Thermophysical Properties Of Metallic Powders

Keyword(s) :
Thermophysical Properties; Thermal Conductivity; Thermal Diffusivity; Characterization of Powder; Additive Manufacturing

Abstract :
PBF-LB|M is the most suitable process for the additive manufacturing with metallic powders when it comes to complex parts with geometrical accuracy. Nevertheless, some unknown variables are present in the process. Especially the thermal conductivity adds high degrees of uncertainty, due to the significant influence of the heat flux from the part to the powder batch on the resulting properties of the part. A lack of experimental data addressing the thermophysical properties of powder and a deep understanding of the influences amplifies this problem. This work presents the thermophysical properties of different steels powders which are commonly used in the PBF-LB|M process using a newly developed powder container. In a quantitative comparative analysis with the corresponding solid materials, it could be shown that chemical composition and microstructure play a subordinate role in the resulting heat conductivity. It is rather powder size distribution the key parameter defining the emerging behaviour.

Innovative Aspect(s) :
The here presented work shows the thermophysical properties of different steel powders and assesses a deep understanding on the influences on these properties like it has never been done bevore. In this work, a newly developed powder capsule has been used to determine the powder's thermal diffusivity directly, enabling a closer look at this significant part of the thermal conductivity. By the comparison of the powder properties with the corresponding solid materials, the influence of the microstructure and chemical composition can be analysed. Furthermore, by the comparison of different particle sizes, the influences on the thermophysical properties can be pointed out in detail, enabling a novel and deep understanding of the addressed properties.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023 CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235764669

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Other tools for improving PM

Author : Mr Medina Peschiutta Alexander (University of Luxembourg | Ceratizit Luxembourg SARL|, Luxembourg)

Co-author(s) : Dr Useldinger Ralph (Ceratizit Luxembourg SARL, Luxembourg), Dr Baller Jörg (University of Luxembourg, Luxembourg), Mr Just Marvin (University of Luxembourg & Ceratizit Luxembourg SARL, Luxembourg)

Title : Comparative Study On The Methods To Determine The Critical Particle Volume Content Of Hard Metal Paste

Keyword(s) :

Abstract :

We present a comparative study on determining the critical particle volume content (CPVC) of a hard metal paste using the following techniques: theoretical calculation, density method, oil titration, binder titration, and Reddy's model. The theoretical calculation involves density measurements to discern the metallic powder-free volume. The density method lies in the principle of void formation in the paste as the solid fraction is increased. The titration methods consist of a stepwise increase of the organic content while the mixer torque is recorded. In contrast, Reddy's model requires the preparation of several feedstocks at varying solid loadings, which are tested in a capillary rheometer to obtain the CPVC. The paste consists of tungsten carbide-cobalt (metallic phase) and a macromolecular multiphase system (organic phase). An optimal solid loading range for a proprietary binder system is nominated.

Innovative Aspect(s) :

The research's comparative aspect illustrates how the different methods affect the value of the critical particle volume content. Applying these techniques to a tungsten carbide with fine grain size is another innovative area of the study.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....

EURO PM2023 CONGRESS & EXHIBITION
01-04 October 2023

Paper Number : EP235765515

Requested presentation type : Oral Presentation

Topic : Tools for improving PM **Subtopic :** Other tools for improving PM

Author : Dr Ing Nasiri Aida (Ionics SA, Belgium)

Co-author(s) :

Title : Powder Functionalization By Low Temperature Low Pressure PVD, PECVD And Ion Implantation Technologies

Keyword(s) :
PVD; PECVD; Ion Implantation; Alloys; Core-Shells; Functionalization; Coatings; Surface Layers; Additive Manufacturing; Sintering

Abstract :
Coating and functionalization of powders by low pressure surface treatment technologies has proven to be very efficient to enhance manufacturing processes and final product performances. Though the theoretical advantages are being explored in academic institutes, the challenges to have a fine-tuned and homogenous product with cost effective process at industrial scale were not currently addressed. Ionics Surface Technologies has industrialized Physical Vapor Deposition (PVD), Plasma-Enhanced Chemical Vapor Deposition (PECVD) and ion implantattion (IBI) coating system adapted to any types of powders. Metal and ceramics could be deposited on various powders in the form of dots, layers, or core-shells . Some of the potential applications among the numerous possibilities include: surface activation, protective or active layers deposition, fine-tuned new alloys development, surface structuration, multilayers architecture and so on. Examples of surface modification of different powders by the three aforementioned technologies and some industrial applications are presented in this manuscript.

Innovative Aspect(s) :
Modification of powders surface with low pressure technologies to develop new alloys, enhanced manufacturing processes efficiency and produced parts with increased performances or new properties.

Reviewer's name : .....

Keynote ☐ Oral ☐ 1☐ 2☐ 3☐ 4☐

Poster ☐ Poster & Reserve Oral ☐

Withdraw ☐ Reason : .....

Notes to author : .....

.....