Recycling mine tailings in chemically bonded ceramics - A review

Mine tailings account for most of the environmental incidents related to the extractive industry, with risks increasing due to steadily rising tonnage of low-grade ore and extreme weather events. Recycling of tailings in raw-material-intensive applications presents an interesting alternative to costly tailings management with associated restoration efforts. Chemically bonded ceramics may offer a route to upgrading mine tailings into raw materials for ceramics. In this review such chemically bonded ceramic methods that may be used to recycle mine tailings as raw materials, are reviewed while focusing in particular on two methods: 1) geopolymerization/alkali activation and 2) chemically bonded phosphate ceramics. The aim of the review is not to give exhaustive review on the wide topic, but to scope the required boundary conditions that need to be met for such utilization. According to the findings, alkali activation has been studied for 28 separate silicate minerals in the scientific literature, and presents a viable method, which is already in commercial use in calcium-rich cement-like binder applications. Phosphate bonding literature is more focused on phosphate containing minerals and waste encapsulation. Very little work has been done on low-calcium tailings utilization with either technology, and more knowledge is needed on the effect of different pre-treatment methods to increase reactivity of mine tailings in chemically bonded ceramics.

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Organisations: Materials Science, Research group: Ceramic materials, University of Oulu
Authors: Kinnunen, P., Ismailov, A., Solismaa, S., Sreenivasan, H., Räisänen, M., Levänen, E., Illikainen, M.
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Scopus rating (2014): SJR 1.661 SNIP 2.477 CiteScore 4.6
Scopus rating (2013): SJR 1.644 SNIP 2.581 CiteScore 4.47
Scopus rating (2012): SJR 1.706 SNIP 2.328 CiteScore 4.07
Scopus rating (2011): SJR 1.461 SNIP 1.825 CiteScore 3.19
Scopus rating (2010): SJR 1.419 SNIP 1.742
Scopus rating (2009): SJR 0.942 SNIP 1.544
Scopus rating (2008): SJR 0.813 SNIP 1.354
Scopus rating (2007): SJR 0.942 SNIP 1.489
Scopus rating (2006): SJR 0.842 SNIP 1.543
Scopus rating (2005): SJR 0.544 SNIP 1.357
Scopus rating (2004): SJR 0.753 SNIP 1.818
Scopus rating (2003): SJR 0.501 SNIP 1.152
Scopus rating (2002): SJR 0.481 SNIP 1.103
Scopus rating (2001): SJR 0.419 SNIP 0.85
Scopus rating (2000): SJR 0.694 SNIP 0.888
Scopus rating (1999): SJR 0.276 SNIP 0.775
Original language: English
DOIs: 10.1016/j.jclepro.2017.10.280
Research output: Scientific - peer-review › Article

Huokoisia keraameja matalaenergisillä prosessointimenetemillä kaivosten rikastushiekoista

General information
State: Published
Organisations: Materials Science, Research group: Ceramic materials, Research group: Ceramic materials, Geologian tutkimuskeskus, University of Oulu
Authors: Solismaa, S., Räisänen, M., Illikainen, M., Kinnunen, P., Karhu, M., Kiviytö-Reponen, P., Lagerbom, J., Ismailov, A., Levänen, E.
Number of pages: 2
Fracture Characteristics of High-Velocity Suspension Flame-Sprayed Aluminum Oxide Coatings

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Materials Science, Research group: Surface Engineering, Research group: Materials Characterization, University of Stuttgart
Authors: Kiilakoski, J., Lutoschkin, A., Plachetta, M., Apostol, M., Koivuluoto, H., Killinger, A., Vuoristo, P.
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ASJC Scopus subject areas: Surfaces, Coatings and Films, Engineering (miscellaneous)
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Research output: Scientific › Conference contribution

Functionalizing Surface Electrical Potential of Hydroxyapatite Coatings

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Materials Science, Research group: Surface Engineering, Riga Technical University, University of Adelaide
Authors: Pluduma, L., Freimanis, E., Gross, K., Koivuluoto, H., Algate, K., Haynes, D., Vuoristo, P.
Number of pages: 6
Pages: 12-17
Publication date: 2016

Host publication information
Title of host publication: 11th International Conference Medical Applications of Novel Biomaterials and Nanotechnology
Volume: 102
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Name: Advances in Science and Technology
Volume: 102
ISSN (Print): 1661-819X
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JUFOID=75599
Research output: Scientific - peer-review › Conference contribution

Towards material excellence: Evaluation of Tekes' programmes on materials

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Department of Materials Science, Research group: Plastics and Elastomer Technology, Virebit Oy
Authors: Timonen, J., Antikainen, M., Das, A., Sarlin, E., Vuorinen, J.
Number of pages: 61
Publication date: 2016
Thermal flow permeametry - A rapid method for finding local changes in flow channels

Solid bodies with flow channels can have very heterogeneous structure, whose local variations are difficult to analyze. Yet, this can play an important role affecting characteristics, such as, fluid flow property, strength and heat conductivity. This article presents a method named thermal flow permeametry (TFP) that is applicable for a quick analysis of variations in flow channels, even in meter-sized structures. For illustrating the method, we analyzed the local permeability levels of a large and extremely complex fiber structure. In TFP, hot air is ejected through a structure, while thermal camera measures local surface temperature variations during heating. Gray values of the thermal image are then plotted versus the structures local thickness, density and permeability. We showed that gray values link with local permeability, affected by thickness, density and flow channel tortuosity. We also found out that TFP is very sensitive to local changes in flow channels.
Suomen keraaminen seura - Keramiska sällskapet i Finland
An Article about the history and present state of the Finnish ceramic society

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Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Materials Science, Research group: Ceramic materials
Authors: Frankberg, E. J.
Number of pages: 1
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Research output: Professional Article

Mechanical characterization of fiber ceramics: Effect of temperature
Fibrous ceramic structures are used in thermal insulators and filters in high-temperature processes. Their mechanical properties are surprisingly complex, being governed by force fields transmitting in the net of fibers. Examining how the fibers link to each other sheds light to this quandary. Extent of linking is defined by the fiber free length (deep red), which is the distance between the closest contact points (green) of a fiber. Decrease of free length, as neighboring fibers (blue) develop contacts, explains why these structures turn rigid with heat. When analyzed with grit blasting, this can be used to discover the structure's thermal history.

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Research group: Ceramic materials, Research group: Applied Material Science, Engineering materials science and solutions (EMASS)
Authors: Järveläinen, M., Humalamäki, J., Laakso, J., Levänen, E.
Number of pages: 10
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Peer-reviewed: Yes

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Scopus rating (2016): SJR 0.826 SNIP 1.083 CiteScore 2.07
Scopus rating (2015): SJR 0.807 SNIP 1.045 CiteScore 1.82
Scopus rating (2014): SJR 0.805 SNIP 1.089 CiteScore 1.66
Scopus rating (2013): SJR 0.733 SNIP 0.843 CiteScore 1.59
Scopus rating (2012): SJR 0.779 SNIP 0.959 CiteScore 1.46
Scopus rating (2011): SJR 0.828 SNIP 1.035 CiteScore 1.58
Scopus rating (2010): SJR 1.097 SNIP 1.14
Scopus rating (2009): SJR 1.283 SNIP 1.106
Scopus rating (2008): SJR 1.267 SNIP 1.153
Scopus rating (2007): SJR 1.014 SNIP 1.157
Characterization Of High-Velocity Single Particle Impacts On Thermally Sprayed Ceramic Coatings

High-velocity impact wear may have a significant effect on the lifetime of thermally sprayed coatings in multiple applications, e.g. in process- and aero industries. An experimental impact study was performed on thermally sprayed coatings with a high velocity particle impactor (HVPI) in oblique angles to investigate the damage, failure and deformation of the coating. The impact site was characterized with a profilometer, optical microscopy and SEM. Furthermore, the connection between the microstructural details and impact behaviour were studied to reveal the damage and failure characteristics in a more comprehensive level. Additionally, traditional dry-erosion behaviour with small particles and different angles was compared with the high-velocity single particle impact phenomena. Differences in wear volume and deformation of the impact site and in absorbance of kinetic energy were also studied, focusing on the effect of material properties as well as the impact characteristics.

Characterization Of High-Velocity Single Particle Impacts On Thermally Sprayed Ceramic Coatings

Binary TiO2/SiO2 nanoparticle coating for controlling the wetting properties of paperboard

We introduce a flame based aerosol method to fabricate thin films consisting of binary TiO2/SiO2 nanoparticles deposited directly from the flame onto the paperboard. Nanocoatings were prepared with Liquid Flame Spray (LFS) in a roll-to-roll process with the line speed of 50 m/min. Surface wetting behavior of nanocoated paperboard was studied for different Ti/Si ratios in the precursor, affecting TiO2/SiO2 ratio in the coating. Wettability could be adjusted to practically any water contact angle between 10 and 1600 by setting the Ti/Si ratio in the liquid precursor. Structure of the two component nanocoating was analysed with FE-SEM, TEM, EDS, XPS and XRD. The porous thin film coating was concluded to consist of ca. 10 nm sized mixed oxide nanoparticles with segregated TiO2 and SiO2 phases. Accumulation of carbonaceous compounds on the surface was seen to be almost linearly dependent on the Ti/Si ratio, indicating of each species being exposed in corresponding amount. However, wetting of the surface was observed to follow merely an S-shaped curve, caused by the roughness of the nanocoated surface. Reasons for the observed superhydrophobicity and superhydrophilicity of these binary nanocoatings on paperboard are discussed. (C) 2014 Elsevier B.V. All rights reserved.
Mechanical performance and CO2 uptake of ion-exchanged zeolite A structured by freeze-casting

Zeoite 4A has been freeze-cast into highly porous monoliths with a cylindrical shape. The brittle monoliths, with lamellar or columnar pores and wall thicknesses between 8 and 35μm, show a compressive mechanical response along the main pore axis that could be modeled by a buckling behavior. The failure strength is proportional to the density and the amount of transverse bridging across lamella, which was shown to be related to the pore cross-sectional aspect ratio. Monoliths with highly anisotropic pores with a cross-sectional aspect ratio higher than 3 yielded sequentially from the top surface, whereas monoliths with a pore aspect ratio lower than 3 were found to delaminate into longitudinal splinters. The freeze-cast monoliths show a sharp gas breakthrough front with a 1:9 mixture of CO<inf>2</inf> and N<inf>2</inf>, indicating rapid uptake kinetics of the lamellar structures.
Versatile erosion wear testing with the high speed slurry-pot

The high speed slurry-pot tester was developed for application oriented erosion wear testing of materials used in mineral handling and processing. It enables tests in demanding high stress abrasive and erosive environments simulating wear, for example in slurry pumps, tanks and pipes, mineral crushing and grinding, loader buckets, dredging, and drilling. The key design features of the test method are the possibility to use up to 10 millimeter sized particles and sample speeds up to 20 m/s in conditions ranging from wet slurry environments to dry sand or gravel.

The tester has been used to test many different material types, including conventional steels, surface treated steels, cast irons, thick and thin coatings, ceramics, hybrid materials, polymers and elastomers. With the high speed slurry-pot tester, samples of various types and sizes can be tested.

In the FIMECC BSA/P2/SP3 project, the focus is in the testing of materials intended for demanding wear related applications. Moreover, the test system is further developed for various wear conditions, including slurry-erosion, grinding abrasion, and sub-zero temperatures.

University-Industry Co-operation Using a Practice-based Innovation Tool: Case Advisory Professorship Programme in Materials Technology

In the thesis the usability and effectiveness of a practice-based innovation tool for university–industry co-operation, the advisory professorship model, is evaluated. The research material was collected by applying the tool with a materials technological emphasis in the regional co-operation network in 2008–2012. The inputs, functions and internal dynamics of the innovation environment, as well as the results and effects of innovation activities in the materials technology advisory professorship programme (MTAP) network, are analysed qualitatively using a conceptual framework for the evaluation of regional innovative capability and the Network-Based Innovative Capability (NBIC) matrix. In the network of the MTAP programme, new practice-based innovation processes, concentrated in practice-based problems and development targets in companies products, operational environment or markets were created. The role of the university was especially in producing of information in the front-end phases of innovation processes, related mostly to properties and processing knowledge of materials, the feasibility of development ideas and in searching of new R&D opportunities. The nature of university based research inputs was typically fast and short-termed. Some innovation processes ended up as new products or product improvements. New knowledge, information and knowledge networks were created. The advisory professorship model can be considered a useful practice-based innovation tool for regional university–industry cooperation with some limitations. In the thesis the materials technology related regional resources, infrastructure and needs from both private and public sectors are also studied and levels of regional availability, access and delivery options for materials technological research are analysed in the Lahti region. Based on this information, it is suggested how the knowledge, network and innovation system related to materials technology should be developed further by public policies and strategies in the region.
Switchable water absorption of paper via liquid flame spray nanoparticle coating

Surface wetting/anti-wetting and liquid absorption are relevant properties of many porous solids including paper and other cellulose-based materials. Here we demonstrate how surface wetting by water and water absorption of commercially available kraft paper can be altered by thin nanoparticle coatings fabricated by liquid flame spray in facile and continuous one-step process. Surface wettability and absorption properties of paper increased with silica and decreased with titania (TiO2) nanoparticle coatings. Moreover, the water-repellent (superhydrophobic) TiO2 nanoparticle coated paper could be switched to superhydrophilic and water absorbing by ultraviolet illumination. The experiments revealed that although surface wetting and liquid absorption of nanoparticle coated paper are strongly related to each other, they are two distinct phenomena which do not necessarily correlate. We propose wetting regimes on the nanoparticle coated paper samples on the basis of the experimental observations.
Abrasion, Erosion and Cavitation Erosion Wear Properties of Thermally Sprayed Alumina Based Coatings

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Organisations: Department of Materials Science
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Portfolio EDEND: 2014-12-01
Publisher name: M D P I AG
Source: researchoutputwizard
Source-ID: 1051
Research output: Scientific - peer-review › Article

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Organisations: Department of Materials Science
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Adjustable wetting of Liquid Flame Spray (LFS) TiO2-nanoparticle coated board: Batch-type versus roll-to-roll Stimulation methods

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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Department of Physics, Engineering materials science and solutions (EMASS)
Authors: Tuominen, M., Teisala, H., Haapanen, J., Aromaa, M., Mäkelä, J. M., Stepien, M., Saarinen, J. J., Toivakka, M., Kuusipalo, J.
Number of pages: 9
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Peer-reviewed: Yes

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Scopus rating (2016): CiteScore 1.2 SJR 0.385 SNIP 0.652
Scopus rating (2015): SJR 0.375 SNIP 0.787 CiteScore 0.91
Scopus rating (2014): SJR 0.444 SNIP 0.823 CiteScore 0.99
Scopus rating (2013): SJR 0.389 SNIP 0.684 CiteScore 0.71
Scopus rating (2012): SJR 0.628 SNIP 1.281 CiteScore 1.13
Scopus rating (2011): SJR 0.582 SNIP 0.902 CiteScore 0.78
Scopus rating (2010): SJR 0.658 SNIP 0.764
Scopus rating (2009): SJR 1.167 SNIP 0.984
Scopus rating (2008): SJR 0.928 SNIP 0.857
Scopus rating (2007): SJR 2.018 SNIP 1.035
Scopus rating (2006): SJR 1.002 SNIP 0.951
Scopus rating (2005): SJR 1.181 SNIP 0.997
Scopus rating (2004): SJR 2.08 SNIP 1.354
Scopus rating (2003): SJR 2.952 SNIP 1.129
Scopus rating (2002): SJR 1.836 SNIP 1.145
Scopus rating (2001): SJR 1.12 SNIP 1.147
Scopus rating (2000): SJR 1.086 SNIP 1.154
Scopus rating (1999): SJR 1.086 SNIP 1.001
Original language: English
DOIs: 10.3183/NPPRJ-2014-29-02-p271-279

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Contribution: organisation=mol,FACT1=0.5<br/>Contribution: organisation=fys,FACT2=0.5<br/>Portfolio EDEND: 2014-08-04<br/>Publisher name: Svenska Pappers- och Cellulosaingenioersfoereningen
Source: researchoutputwizard
Source-ID: 1655
Research output: Scientific - peer-review › Article
Antibacterial properties and chemical stability of superhydrophobic silver-containing surface produced by sol-gel route

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Heinonen, S., Huttunen-Saarivirta, E., Nikkanen, J., Raulio, M., Priha, O., Laakso, J., Strogårds, E., Levänen, E.
Number of pages: 13
Pages: 149-161
Publication date: 2014
Peer-reviewed: Yes

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Scopus rating (2014): SJR 0.843 SNIP 1.252 CiteScore 2.81
Scopus rating (2013): SJR 0.811 SNIP 1.255 CiteScore 2.6
Scopus rating (2012): SJR 0.841 SNIP 1.189 CiteScore 2.34
Scopus rating (2011): SJR 0.812 SNIP 1.183 CiteScore 2.43
Scopus rating (2010): SJR 0.872 SNIP 1.115
Scopus rating (2009): SJR 0.848 SNIP 1.059
Scopus rating (2008): SJR 0.886 SNIP 1.041
Scopus rating (2007): SJR 0.795 SNIP 0.978
Scopus rating (2006): SJR 0.822 SNIP 1.091
Scopus rating (2005): SJR 0.813 SNIP 1.004
Scopus rating (2004): SJR 0.844 SNIP 1.106
Scopus rating (2003): SJR 0.824 SNIP 1.033
Scopus rating (2002): SJR 0.763 SNIP 0.945
Scopus rating (2001): SJR 0.825 SNIP 0.971
Scopus rating (2000): SJR 0.69 SNIP 0.782
Scopus rating (1999): SJR 0.621 SNIP 0.82
Original language: English
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Source-ID: 444
Research output: Scientific - peer-review › Article

Applications of supercritical carbon dioxide in materials processing and synthesis

General information
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Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Zhang, X., Heinonen, S., Levänen, E.
Number of pages: 17
Pages: 1-16
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: RSC Advances
Influence of powder composition and manufacturing method on electrical and chromium barrier properties of atmospheric plasma sprayed spinel coatings prepared from MnCo2O4 and Mn2CoO4 + Co powders on Crofer 22 APU interconnectors

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Optoelectronics Research Centre, Engineering materials science and solutions (EMASS), Frontier Photonics
Number of pages: 12
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Publication date: 2014
Peer-reviewed: Yes

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ISSN (Print): 0360-3199
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Scopus rating (2015): SJR 1.294 SNIP 1.319 CiteScore 3.46
Scopus rating (2014): SJR 1.212 SNIP 1.494 CiteScore 3.54
Scopus rating (2013): SJR 1.278 SNIP 1.467 CiteScore 3.38
Scopus rating (2012): SJR 1.515 SNIP 1.729 CiteScore 3.96
Scopus rating (2011): SJR 1.456 SNIP 1.837 CiteScore 4.42
Scopus rating (2010): SJR 1.589 SNIP 1.871
Scopus rating (2009): SJR 1.333 SNIP 1.885
Scopus rating (2008): SJR 1.401 SNIP 2.096
Scopus rating (2007): SJR 1.279 SNIP 2.201
Scopus rating (2006): SJR 1.073 SNIP 2.161
Scopus rating (2005): SJR 1.107 SNIP 1.787
Scopus rating (2004): SJR 1.225 SNIP 1.626
Scopus rating (2003): SJR 1.003 SNIP 1.319
Scopus rating (2002): SJR 0.763 SNIP 1.157
Scopus rating (2001): SJR 0.487 SNIP 1.185
Scopus rating (2000): SJR 0.518 SNIP 0.866
Scopus rating (1999): SJR 0.382 SNIP 0.897
Original language: English
DOIs:
Influence of the powder morphology and plasma play process parameters on the structure and properties of Al2O3 based plasma sprayed coatings

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Materials Science
Authors: Matikainen, V., Koivuluoto, H., Vuoristo, P., Larjo, J.
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Publication series
Name: DVS-Berichte
Volume: 302
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Multifunctional superhydrophobic nanoparticle coatings for cellulose based substrates by liquid flame spray

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Organisations: Department of Materials Science
Authors: Teisala, H.
Number of pages: 1
Pages: 59
Publication date: 2014
Peer-reviewed: Unknown

Publication information
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Bibliographical note
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Source: researchoutputwizard
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Research output: Professional › Article

Nanoparticle Depositon on Packaging Materials by Liquid Flame Spray: Generation of Superhydrophilic and Superhydrophobic Coatings
Paper-based microfluidics: Fabrication technique and dynamics of capillary driven surface flow

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Department of Physics, Engineering materials science and solutions (EMASS)
Authors: Songok, J., Tuominen, M., Teisala, H., Haapanen, J., Mäkelä, J. M., Kuusipalo, J., Toivakka, M.
Number of pages: 7
Pages: 20060-20066
Publication date: 2014
Peer-reviewed: Yes

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Journal: ACS Applied Materials and Interfaces
Volume: 6
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ISSN (Print): 1944-8244
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Scopus rating (2015): SJR 2.299 SNIP 1.568 CiteScore 7.38
Scopus rating (2014): SJR 2.126 SNIP 1.64 CiteScore 6.88
Scopus rating (2013): SJR 1.979 SNIP 1.543 CiteScore 6.05
Scopus rating (2012): SJR 2.18 SNIP 1.309 CiteScore 4.94
Scopus rating (2011): SJR 2.017 SNIP 1.396 CiteScore 4.41
Scopus rating (2010): SJR 1.571 SNIP 0.931
Original language: English
DOIs:
10.1021/am5055806

Bibliographical note
Contribution: organisation=mol,FACT1=0.5<br/>Contribution: organisation=fys,FACT2=0.5<br/>Portfolio EDEND: 2014-12-30
Publisher name: American Chemical Society
Source: researchoutputwizard
Source-ID: 1538
Research output: Scientific - peer-review › Article

Post-mortem evaluation of oxidized atmospheric plasma sprayed Mn-Co-Fe oxide spinel coatings on SOFC interconnectors
General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
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Publication date: 2014
Peer-reviewed: Yes

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Ratings:
Scopus rating (2016): CiteScore 3.74 SJR 1.142 SNIP 1.286
Scopus rating (2015): SJR 1.294 SNIP 1.319 CiteScore 3.46
Scopus rating (2014): SJR 1.212 SNIP 1.494 CiteScore 3.54
Scopus rating (2013): SJR 1.278 SNIP 1.467 CiteScore 3.38
Scopus rating (2012): SJR 1.515 SNIP 1.729 CiteScore 3.96
Scopus rating (2011): SJR 1.456 SNIP 1.837 CiteScore 4.42
Scopus rating (2010): SJR 1.589 SNIP 1.871
Scopus rating (2009): SJR 1.333 SNIP 1.885
Scopus rating (2008): SJR 1.401 SNIP 2.096
Scopus rating (2007): SJR 1.279 SNIP 2.201
Scopus rating (2006): SJR 1.073 SNIP 2.161
Scopus rating (2005): SJR 1.107 SNIP 1.787
Scopus rating (2004): SJR 1.225 SNIP 1.626
Scopus rating (2003): SJR 1.003 SNIP 1.319
Scopus rating (2002): SJR 0.763 SNIP 1.157
Scopus rating (2001): SJR 0.487 SNIP 1.185
Scopus rating (2000): SJR 0.518 SNIP 0.866
Scopus rating (1999): SJR 0.382 SNIP 0.897
Original language: English
DOIs:
10.1016/j.ijhydene.2014.08.105

Bibliographical note
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Source: researchoutputwizard
Source-ID: 1307
Research output: Scientific - peer-review › Article

Properties of WC-FeCrAl coatings manufactured by different high velocity thermal spray processes

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Materials Science, Engineering materials science and solutions (EMASS)
Authors: Bolelli, G., Hulka, I., Koivuluoto, H., Lusvarghi, L., Milanti, A., Niemi, K., Vuoristo, P.
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Review on Liquid Flame Spray in paper converting: Multifunctional superhydrophobic nanoparticle coatings

Wettability of a solid surface by a liquid plays an important role in several phenomena and applications, for example in adhesion, printing, and coating. Especially, wetting of rough surfaces has attracted a considerable scientific interest in recent decades. Superhydrophobic surfaces, which possess extraordinary water repellency properties due to their low surface energy chemistry and specific nano- and microscale roughness, are of particular interest due to the great variety of potential applications ranging from self-cleaning surfaces to microfluidic devices. Here we examine functional superhydrophobic and superhydrophilic nanoparticle coatings fabricated by liquid flame spray (LFS) on cellulose-based substrate materials. The article is a review of earlier papers with some new results and conclusions added. LFS has proved itself straightforward and versatile one-step method to fabricate broad range of functional nanoparticle coatings on various substrate materials in an atmospheric roll-to-roll process. It has established itself among the most potential candidates for large-scale production of superhydrophobic coatings on affordable cellulose-based substrates.

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Authors: Teisala, H., Tuominen, M., Haapanen, J., Aromaa, M., Stepien, M., Mäkelä, J. M., Saarinen, J. J., Toivakka, M., Kuusipalo, J.
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Selective morphologies of MgO via nanoconfinement on γ-Al2O3 and reduced graphite oxide (rGO): improved CO2 capture capacity at elevated temperatures
Surface Processing of Zirconia Ceramics by Laser

The aim of this study was to investigate phase transformations and glazing of zirconia bulk ceramic as a function of laser processing parameters. Zirconia-based ceramics have good material properties for a variety of applications. The main advantage of zirconia compared to other structural ceramics, like silicon-based ceramics and alumina, is its high fracture toughness (typically over 10MPa√m). This property is largely based on partial stabilization of zirconia, where a portion of the material is in metastable phase, enabling instantaneous phase transformation under mechanical load. This consumes energy otherwise provided to crack propagation. The stable phase of zirconia to exist in room temperature is monoclinic; therefore a rapid cycle of heating and cooling is necessary for achieving metastable tetragonal phase. Pulsed laser processing offers just the right type of thermal cycle for the aforementioned phase transformation to occur. In this study a nanosecond pulsed laser was used for surface processing of zirconia ceramic blocks.

During laser processing high energy can be concentrated into small area, causing sudden local heating, which in turn causes material to melt and vaporize instantly. However, heat dissipation remains small due to the short pulse length, leading to the desirable cycle. Temperatures in the process correlate with several parameters: pulse width, peak energy, repetition rate, pulse overlap, material properties and wavelength. Zirconia is a tough material to process in terms of material removal with laser ablation, since it tends to melt rather than evaporate.
Topically applied ZnO nanoparticles suppress allergen induced skin inflammation but induce vigorous IgE production in the atopic dermatitis mouse model

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Scopus rating (2012): SJR 3.032 SNIP 2.075 CiteScore 8.84
Scopus rating (2011): SJR 2.705 SNIP 1.887 CiteScore 7.51
Scopus rating (2010): SJR 2.102 SNIP 1.385
Scopus rating (2009): SJR 2.138 SNIP 1.743
Scopus rating (2008): SJR 2.152 SNIP 1.82
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Tribological behavior of HVOF- and HVAF-sprayed composite coatings based on Fe-Alloy + WC-12% Co

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