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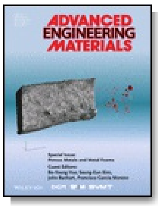
Advanced Engineering Materials



Special Issue: Porous Metals and Metal Foams

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Issue edited by: Bo-Young Hur, Seung-Eun Kim, John Banhart, Francisco García Moreno

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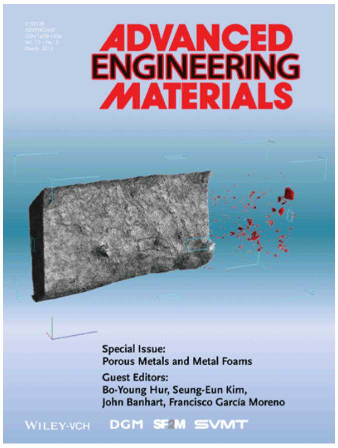

The microstructure of metallic foams can be analyzed three-dimensionally via the synchrotron-based X-ray microtomography. The 3D morphology of the cell wall of an Al-Zn-Mg foam has been revealed. The solid matrix is virtually removed in the right half of the figure, visualizing the spatial distribution of micro-pores inside the cell wall. For details see the article by Zhang et al. on page 149.

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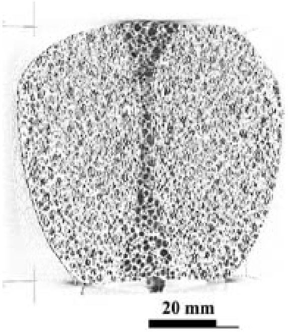
Andrew R. Kennedy
Article first published online: 10 SEP 2012 | DOI: 10.1002/adem.201200122



Aluminum machining chips have been successfully foamed using processes analogous to both the "Alporas" and "Formgrip" methods. The chips provide large fractions of both clustered and dispersed oxide films to the liquid, which enhances its "foamability." Through additional alloying with Mg and "melt conditioning," fragmentation and wetting of the oxides occurs and foams with low densities, good pore structures, and good stability are obtained.

Abstract | **Full Article (HTML)** | **PDF(491K)** | **References** | **Request Permissions**
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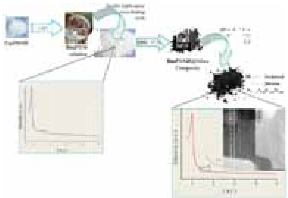
Direct Synthesis of Periodic Mesoporous SilicoBoron CarboNitride Frameworks via the Nanocasting from Ordered Mesoporous Silica with Boron-Modified Polycarbosilazane (pages 134–140)
Samuel Bernard, Olivier Majoulet, Fabien Sandra, Annie Malchere and Philippe Miele
Article first published online: 19 NOV 2012 | DOI: 10.1002/adem.201200168



Periodic mesoporous SilicoBoron CarboNitride ($Si_{3.0}B_{1.0}C_{3.9}N_{1.8}$) frameworks with p6mm hexagonal symmetry, a specific surface area of 337 $m^2 g^{-1}$, a high pore volume (0.55 $cm^3 g^{-1}$) and a narrow pore-size distribution centered on 4.6 nm with an amorphous network remaining stable during continuous heat-treatment to 1400 °C in a nitrogen atmosphere have been prepared by a direct nanocasting process of ordered mesoporous silica with a boron-modified polycarbosilazane (BmPS).

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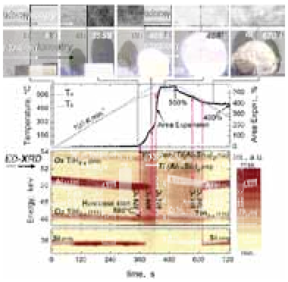
Metal Foaming Studied In Situ by Energy Dispersive X-Ray Diffraction of Synchrotron Radiation, X-Ray Radioscopy, and Optical Expandometry (pages 141–148)
Catalina Jiménez, Francisco Garcia-Moreno, Beate Pfretzschner, Paul Hans Kamm, Tillmann Robert Neu, Manuela Klaus, Christoph Genzel, André Hilger, Ingo Manke and John Banhart
Article first published online: 19 SEP 2012 | DOI: 10.1002/adem.201200183



Three synchronized methods are combined for studying in situ the foaming of AlSi11 using as-received TiH_2 or pre-oxidized TiH_{2-x} as blowing agents. Phase transformations are followed by energy-dispersive X-ray diffraction of synchrotron radiation. The internal structure of the foam is monitored by X-ray radioscopy and a video camera records the foam expansion. The phase transformations of TiH_2 and TiH_{2-x} inside expanding foams are reported here for the first time.

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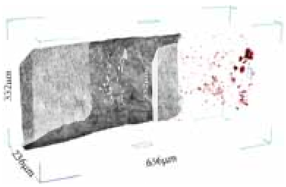
Characterization of Cell Wall Microstructure and Damage Behavior of Alloyed Aluminum Foam via Synchrotron-Based Microtomography (pages 149–152)
Qiang Zhang, Hiroyuki Toda, Masakazu Kobayashi, Kentaro Uesugi and Yoshio Suzuki
Article first published online: 19 OCT 2012 | DOI: 10.1002/adem.201200142



The internal microstructural features of the Al–Zn–Mg foam, such as content, size distribution, shape and spatial distribution of micro-pores inside the cell wall, were characterized via the synchrotron-based X-ray microtomography. Together with a dual energy imaging technique, the 3D distribution of Zn in the alloyed foam was assessed. The damage behavior was also clarified by this element sensitive imaging technique.

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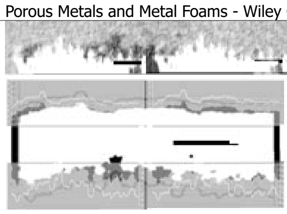
High-Resolution Microfocus X-Ray Computed Tomography for 3D Surface Roughness Measurements of Additive Manufactured Porous Materials (pages 153–158)
Greet Kerckhofs, Grzegorz Pyka, Maarten Moesen, Simon Van Bael, Jan Schrooten and Martine Wevers
Article first published online: 12 OCT 2012 | DOI: 10.1002/adem.201200156

A novel protocol for surface roughness measurements of 3D additive manufactured



(AM) porous structures based on high-resolution micro-CT images is described. The roughness parameters are determined based on the profile lines of the strut surfaces in the binarized 2D cross-sectional micro-CT images. Validation of this novel methodology shows that micro-CT can be applied accurately for micro-scale surface roughness quantification of 3D AM porous materials, but depending on the dimensions of the roughness, the micro-CT acquisition parameters need to be fine-tuned.

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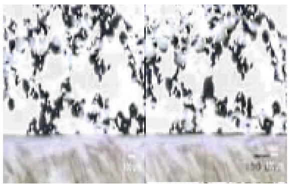
☒ **Properties of Titanium Foams for Biomedical Applications (pages 159–165)**
Louis-Philippe Lefebvre and Eric Baril
Article first published online: 16 OCT 2012 | DOI: 10.1002/adem.201200154



Structure, microstructure, and properties of CpTi and Ti6Al4V foams and coating produced with a powder metallurgy process are presented. Alloying elements and oxygen in solution increase the foam mechanical strength but lower their ductility. Good metallurgical bonding is created between CpTi foam coating and Ti6Al4V substrates and shear strength above the FDA requirements are obtained.

Abstract | **Full Article (HTML)** | **PDF(639K)** | **References** | **Request Permissions**
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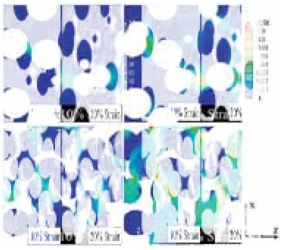
☒ **Effect of Pore Morphology on Deformation Behaviors in Porous Al by FEM Simulations (pages 166–169)**
Yi Je Cho, Wook Jin Lee, Sung Kyun Park and Yong Ho Park
Article first published online: 19 NOV 2012 | DOI: 10.1002/adem.201200145



Effect of porosity and pore shape on compressive deformation behaviors of porous Al is analyzed using 3D finite element method. Representative volume elements of porous microstructures, having four different pore morphologies, are reconstructed using random sequential adsorption algorithm. Consideration of pore morphology can give qualitative information on deformation behaviors of porous metals, and thus may be helpful to design and optimize of the materials.

Abstract | **Full Article (HTML)** | **PDF(325K)** | **References** | **Request Permissions**
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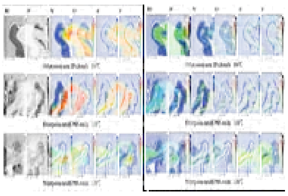
☒ **High Temperature Oxidation of Ni–Fe–Cr–Al Porous Metal (pages 170–174)**
Sung-Hwan Choi, Jae-Sung Oh, Jung-Yeul Yun, Young-Min Kong, Byoung-Kee Kim and Kee-Ahn Lee
Article first published online: 19 NOV 2012 | DOI: 10.1002/adem.201200140



It is apparent that the oxidation resistance of porous metal decreases with decreasing pore size (increasing surface area). It should be also noted here that the weight gain in the porous metals (regardless of the pore size) are significantly large compared with that of the bulk metal (0.19 mg cm^{-2} at 1100 °C oxidation temperature for 24 h).

Abstract | **Full Article (HTML)** | **PDF(442K)** | **References** | **Request Permissions**
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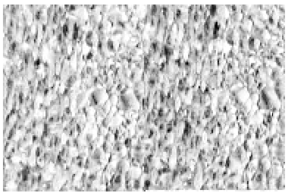
☒ **Relation of Cell Uniformity and Mechanical Property of a Close Cell Aluminum Foam (pages 175–179)**
Wang Deqing
Article first published online: 19 NOV 2012 | DOI: 10.1002/adem.201200135



Closed-cell aluminum foams with uniform and non-uniform cell size are prepared by air-foaming aluminum melt with two techniques. The uniform-celled aluminum foam presents an overall 25% improvement of the yield strength over the one for the non-uniform celled aluminum foam with the same density, and a decreased energy absorption ability.

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