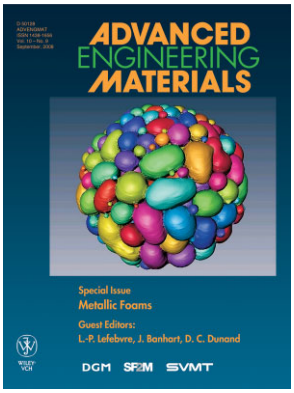
ADVANCED ENGINEERING MATERIALS

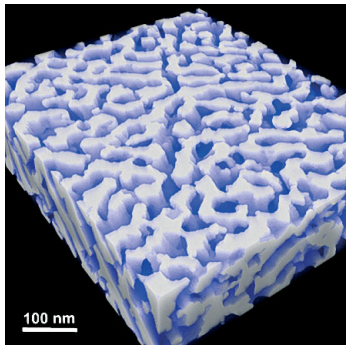
CONTENTS

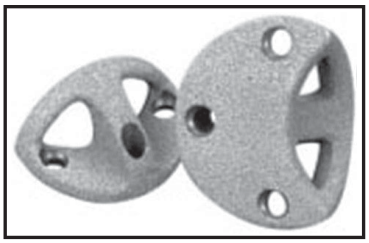


The cover shows the computer-assisted segmentation of individual pores in the sample of an Al-Cu-Mg alloy foamed without blowing agent by pressure manipulation. Read more about this in the article by L.-P. Lefebvre et al. on page 775.

DGM aktuell SF2M Info SVMT

Reviews



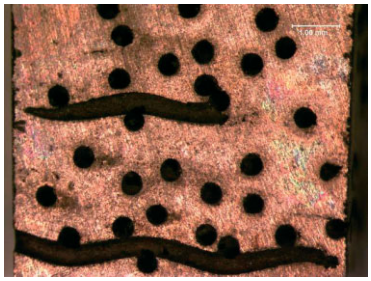


ADVANCED ENGINEERING MATERIALS

Volume 10 (2008) No. 9

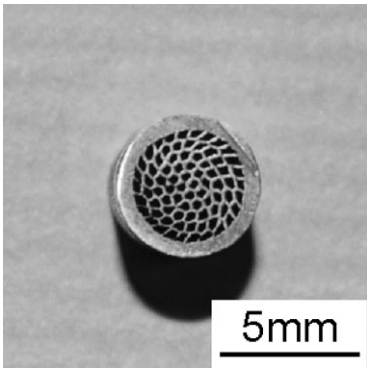
CONTENTS

Porous Titanium by Electro-chemical Dissolution of Steel Space-holders



*P. J. Kwok, S. M. Oppenheimer, D. C. Dunand**

Titanium powders are densified together with steel spheres, wires or wire meshes which are subsequently removed by electrochemical dissolution, creating porosity that replicates the steel space-holders. Interdiffusion between steel and titanium is prevented by formation of a TiC diffusion barrier. Without this barrier, a Fe-containing titanium zone adjacent to the space-holder is formed which can be removed electrochemically, thus increasing the size and volume fraction of the pores.

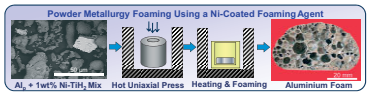


High-Strength Porous Copper by Cold-Extrusion

H. Utsunomiya, H. Koh, J. Miyamoto, T. Sakai*

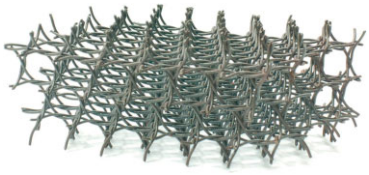
The authors propose a method to fabricate porous metals with high strength in this paper. Pieces of matrix metal and space-holder metal are deformed together by bulk forming for solid-phase bonding. From the bonded composite, only the space-holder metal is removed. If the deformation and the removal are conducted at cold or warm region, 'wrought' high-strength porous metal can be obtained. In this study, using aluminum as space holder, two types of porous copper with one-dimensional pores, i.e., lotus-type and honeycomb-type rods, have been successfully fabricated by cold extrusion followed by chemical leaching. Both the porous coppers fabricated show higher specific yield strength than a conventional porous metal.

Production of Aluminum Foams with Ni-coated TiH_2 Powder



*P. M. Proa-Flores, R. A. L. Drew**

Aluminum foams produced from Ni-coated TiH_2 display higher final densities than those produced with-out the Ni diffusion barrier; however, resulting foams display rounded pores and a narrower pore size distribution. The 1–2 μm Ni-coating layer is produced by an electroless technique, and is strong enough to remain attached to TiH_2 after the mixing and compaction step in the powder metallurgical foaming process.



High Strength-per-Weight Cellular Metals Fabricated of Wires

*Byung-Kon Lee, Ki-Ju Kang**

In pursuit of high specific strength cellular metals, the authors have examined compressive strength of Wire-woven Bulk Kagome (WBK) specimens composed of two different wires, i.e., aluminum alloy wires and spring steel wires. Compression tests give the strength of 1.8 MPa at a density of 0.096 Mg/m^3 for the former and 7.1 MPa at 0.271 Mg/m^3 for the latter. These two WBK specimens outperform most competitors of metal foams with respect to specific strength. In comparison with other Periodic Cellular Metals (PCMs), even though the relative density of the two WBK specimens is substantially lower, their compressive strength and energy absorptions are comparable to those of the square honeycomb and the pyramidal core, which are known as ones of the best PCMs.

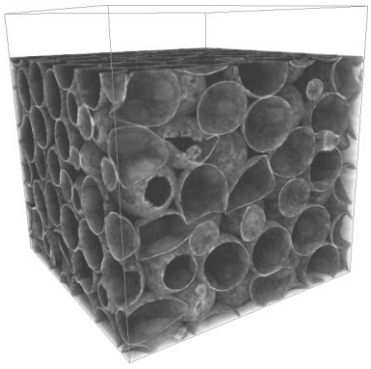
ADVANCED ENGINEERING MATERIALS

Volume 10 (2008) No. 9

CONTENTS

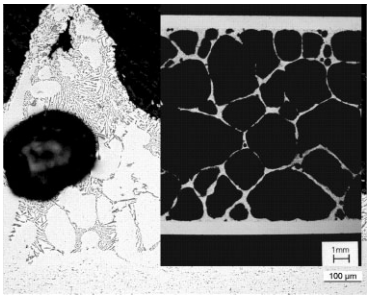
CONTENTS

Mechanical Behaviour of Metallic Hollow Spheres Foam



A. Fallet, P. Lhuissier, L. Salvo, Y. Bréchet*

Structural and mechanical characterization of stainless steel hollow spheres foams has been investigated by X-ray tomography. In-situ compression tests enable to study the main deformation mechanisms that govern the plasticity of the foam. FEM calculations of the compression of a pair of connected spheres have been performed in order to identify the conditions under which either mechanism is operative. Then a macroscopic phenomenological model for the compressive behaviour has been developed. It describes the overall behaviour of the material following damage progression. The model gives a description of an equivalent homogeneous material without loosing information on irreversible mechanisms occurring at the level of the mesostructure.

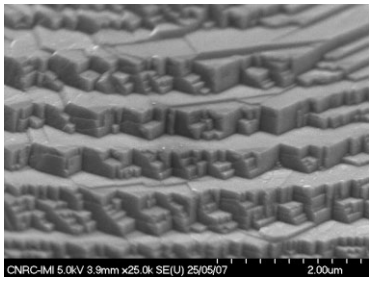


Influence of Core and Face Sheet Materials on Quasi-Static Mechanical Properties and Failure in Aluminium Foam Sandwich

D. Lehmhus, M. Busse, Y. Chen, H. Bomas, H.-W. Zoch*

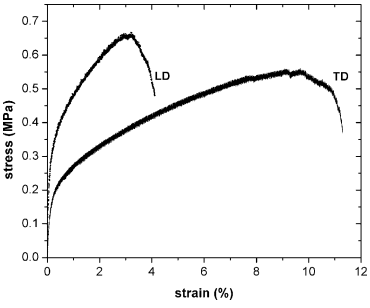
Aluminium foam sandwich (AFS) with metallurgical bonding between face sheets and core has high potential for lightweight design. The present paper studies failure mechanisms and mechanical characteristics under quasi-static bending load to support safe dimensioning of parts. For this purpose, failure charts are provided based on a weakest-link approach which incorporates local material properties and reflects scatter of sandwich properties.

Effect of Oxygen Concentration and Distribution on the Compression Properties on Titanium Foams



*L.-P. Lefebvre, E. Baril**

The effect of oxygen in solution and surface oxide on the properties of titanium foams under compression is discussed in this report. The authors present a simple method to discriminate the amount of oxygen coming from the oxide and from the solid solution. Oxygen in solution has an impact on the hardness, yield strength and ductility while surface oxide has little impact on the compression properties within the concentration evaluated.



The Influence of Cell Shape Anisotropy on the Tensile Behavior of Open Cell Aluminum Foam

E. Amsterdam, H. van Hoorn, J. Th. M. De Hosson, P. R. Onck*

Tensile tests have been performed on annealed (AN) and heat treated (HT) Duocel open cell aluminum foam (20 PPI) samples for relative densities ranging between 3 and 13%. The long axis of the cell was oriented longitudinal (LD) or transverse (TD) to the loading direction to observe the effect of the cell shape anisotropy on the tensile behavior. During the tensile tests the evolution of damage was monitored by measuring the electrical resistance. All changes in the tensile behavior between orientations, such as the flow stress, peak stress and peak strain, can be explained by both the cell shape anisotropy and the change in damage evolution.

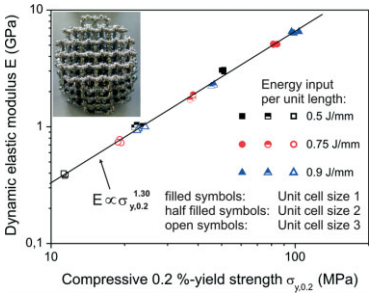
ADVANCED ENGINEERING MATERIALS

Volume 10 (2008) No. 9

Selective Electron Beam Melting of Cellular Titanium: Mechanical Properties

P. Heinl, C. Körner, R. F. Singer*

Cellular titanium seems to be a promising material for medical implant applications due to an elastic modulus comparable with human bone and an interconnected porosity which facilitates bone ingrowth. This paper reports the mechanical properties of non-stochastic cellular Ti-6Al-4V structures fabricated by Selective Electron Beam Melting depending on different unit cell sizes and varying energy input per unit length of the electron beam.



Experimental Demonstration of Entrance/Exit Effects on the Permeability Measurements of Porous Materials

E. Baril, A. Mostafid, L.-P. Lefebvre, M. Medraj*

The pressure drops were measured on metallic foams having uniform structure and different thicknesses, densities and pore sizes. Results indicated that entrance/exit effects can be a significant contributor to the pressure drop when the thickness of the specimens is small. Above a critical thickness, the contribution of the entrance effect on the total pressure drop becomes insignificant and classical models can be applied.

