Synthesis and Properties of Open-celled Metal Foams

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Abstract

Open-celled metal foams are a innovative class of functional material. They combine the benefits of metal properties like excellent heat conductivity and good mechanical strength with those of highly permeable materials. Such unique properties are much-needed for the design of highly stressed thermal management devices, sound absorbers or high temperature resistant carrier for catalytic converter. In the present work open-celled metal foams were synthesized using a replication technique. Therefore a reticulated polyurethane template was coated by a slurry and removed thermally, followed by a sintering step. Since the process is feasible for a multiplicity of metals the experiments were performed on the example of stainless steel 316L. Highly porous components were obtained showing adjustable densities between 0.3 and 2.0 g/cm³. The cell structure is exceedingly homogeneous with the cell sizes may be chosen in the range of 10 - 80 ppi. In order to characterise the properties, compression tests, heat conductivity tests and permeability tests were carried out. A significant influence of the density as well the cell size on the physical properties was noticed.