Properties of Graded Open-celled Metal Foams

J. Adler [1], K. Kümmel [2], P. Quadbeck [2], G. Standke [1], G. Stephani [2]

[1] Fraunhofer Institute Ceramic Technologies and Sintered Materials (IKTS), Winterbergstr. 28, 01277 Dresden
[2] Fraunhofer Institute Manufacturing and Advanced Materials (IFAM), Dept. Powder Metallurgy and Composite Materials, Winterbergstr. 28, 01277 Dresden

Abstract

Open-celled metal foams are a class of functional materials which combine the beneficial features of high permeability and metal properties. As a result of their highly permeable structure, open-celled metal foams show excellent sound absorption properties. However, the majority of open-celled foams exhibit a homogenous structure. Hence, the sound absorption maximum is limited to narrow frequency range only. Using graded pore-structures, the shape of the frequency curve may be broadened and the frequency of the maximum may be shifted. One of the most versatile approaches to prepare such graded open-celled metal foams is the replication technique. Based on a powder-metallurgical approach, it allows the preparation of various densities and pore sizes, respectively. In the present work, open-celled metal foams out of stainless steel 316L, graded structures with densities between 0.3 and 2.0 g/cm³ and pore sizes in the range of 45 – 80 ppi were prepared, using the replication technique. The sound absorption properties of such structures with varying density gradients as well as pore size gradients were tested in an impedance tube. Furthermore, pressure drop of the components was tested in order to characterise permeability. A significant influence of the graduation on the physical properties was noticed.