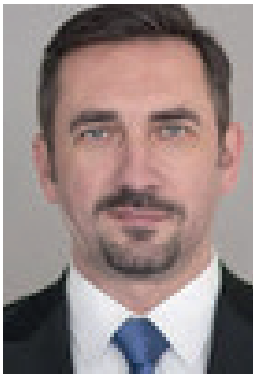

Cellular Metals in Thermal Management Applications – Opportunities and Lim-itations

Prof. Jens Meinert, University of Applied Sciences Zittau/Görlitz (Germany)

Cellular metals like foam, fiber, wire and hollow sphere structures offer a large number of ap-plications in the field of thermal management and power engineering. The unique combination of special characteristics such as high open/closed porosity, high heat conductivity of the bulk structure, large volumetric inner surface and mechanical strength recommend these materials for applications in compact thermal management devices. Representative examples are high-power heat exchangers and latent heat storage or buffering devices, high-temperature thermal insulation and catalysts and filters, respectively.
An effective implementation of cellular structures, especially cellular metals, in thermal man-age-ment systems requires a detailed analysis of the thermal and flow characteristics with re-spect to the boundary conditions of the special application. Based on this statement it has to be considered that cellular metals on the one hand offer numerous opportunities for the use in thermal management which are on the other hand opposed by several limitations.
The keynote presents a wide range of experiences and results from several years of experi-mental and theoretical research at the Fraunhofer IFAM Dresden in the field of characterizing cellular metals with respect to thermal applications. This includes the development of experi-mental setups to determine thermal properties, effective thermal transport coefficients and flow parameters as well as methods to evaluate the measured data. A next step is the deriva-tion of semi-empirical approaches to describe the measured characteristics mathematically with a high level of generalization.
Applying the empirical correlations or the measured data base, the thermal and flow design of appli-cations in the field of thermal management is possible and conclusions can be drawn with respect to the suitability of the cellular structures. The spectrum of these conclusions varies from highly efficient to non-advisable applications of cellular metals.