

PORE SCALE ANALYSIS OF THERMAL AND FLUID DYNAMICS BEHAVIORS IN OPEN METAL FOAMS

Bernardo Buonomo, Anna di Pasqua, Oronzio Manca, Sergio Nappo, Sergio Nardini, Safa Sabet

ABSTRACT The investigation of fluid flow in porous media has been of great interest for engineers and scientist in recent years. Many applications, such as in refrigeration, automotive, aerospace, process industry and heat exchangers, energy systems and thermal energy storage use porous media to increase thermal performance. Metal foams are a new type of material and are used to improve heat exchange in many components and systems. The related behavior is influenced by the structure of the foam and by parameters such as diameters of cells, struts, and pore density, the shape of struts and the porosity. The structure can be realized by a forming technological process or by additive manufacturing (AM) it is non-ordered-random (stochastic) structure or AM-ordered structure, respectively. The structures present different fluid dynamic and thermal characteristics. The huge applications in heat transfer of metal foams, both stochastic and AM-ordered, and the need to improve the convective heat transfer performances are determining to understand better the phenomenology more in depth to evaluate the pressure drop and local heat transfer coefficient at pore-scale level as underlined in literature. In the present investigation an analysis on Kelvin cells which can represent both the stochastic foam and the ordered foam is accomplished to analyze different characteristics with phase change materials, low pressure gas cases or microscale systems, and nanofluids. Some results related to the entropy generation analysis are also presented.