THE INFLUENCE OF SPACING OF SEGMENTED METAL FOAM ON AIRFLOW PRESSURE DROP

Nihad Dukhan* and Mukdad M. Musa
Department of Mechanical Engineering
University of Detroit Mercy
4001 W. McNichols Rd.
Detroit, MI 48334
USA
*Correspondence author: Fax: +313 993 1187 Email: ndukhan@att.net

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ABSTRACT

Open-cell metal foam is a class of modern porous media that possesses high thermal conductivity, large accessible surface area per unit volume and high porosities (often greater than 90%). The internal structure of the foam is web-like that produces a complex flow field, including turbulence, flow reversal and mixing, when a fluid passes through it. All of these attributes make metal foam a very attractive core for many applications, e.g. heat exchange. The penalty is an increase in pressure drop. However, this increase can be mild and the foam can compete with the most compact heat exchange cores. Experiments presented here showed a rather peculiar behavior of the pressure drop in aluminum foam when the foam core was sectioned and the sections placed at equal distance from each other forming a discontinuous core. In particular, there was no increase in pressure drop, even though sectioning the foam increases the number of entrances and exits in the flow path. The experiment was run in an open-loop wind tunnel and the foam sections were cylindrical having a height of 2.45 cm (1 inch) and a diameter of 8.89 cm (3.5 inches). The foam tested had 10 pores per inch (ppi). The behavior of the pressure drop was further investigated in terms of the permeability and form drag coefficient. The former is a measure of viscous drag and the latter of the form drag. The results of this paper are critical for metal-foam heat exchange designs.