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A precursory analysis of cryogenic radiant coolers with open-cell metallic foam fins

Content :

Instrumentations onboard space vehicles generate heat that has to be dissipated so as to sustain within the permissible operating temperatures. One of the commonly employed devices for this purpose are passive cryogenic radiant coolers that provide cooling by dumping the heat via thermal radiation to the cold surrounding space. The existing passive radiators function at a temperature range of 60–300 K. Cryogenic radiant coolers demand surfaces with high emissivity, large heat transfer surface area and low weight. Consequently, cellular materials such as honeycomb structures, known for being light and having high surface area density, have already paved their way in the design of some of the futuristic radiator surfaces. On parallel grounds, another class of cellular materials gaining widespread attention is high porosity open-cell metallic foams. These have interconnected struts with porosity of the order of 90–98%. The porosity is responsible for incident radiation being able to penetrate within few layers from the foam surface. This results in an augmentation of the surface area involved in radiative heat exchange. The present work focuses on the probable use of high porosity open-cell metallic foams as fins for passive radiant cooler surfaces.

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