



Review

Steel foam for structures: A review of applications, manufacturing and material properties

B.H. Smith ^a, S. Szyniszewski ^b, J.F. Hajjar ^c, B.W. Schafer ^{b,*}, S.R. Arwade ^a

^a Dept. of Civil & Env. Engg. University of Massachusetts, Amherst, MA 01003, USA

^b Dept. of Civil Engg., Johns Hopkins University, Baltimore, MD 21218, USA

^c Dept. of Civil & Env. Engg., Northeastern University, Boston, MA 02115, USA

ARTICLE INFO

Article history:
 Received 2 August 2011
 Accepted 29 October 2011
 Available online 9 December 2011

Keywords:
 Steel
 Metal foams
 Cellular solids
 Structural engineering
 Mechanical properties

ABSTRACT

The objective of this paper is to provide a state-of-the-art review for the structural application, manufacturing, material properties, and modeling of a new material: steel foam. Foamed steel includes air voids in the material microstructure and as a result introduces density as a new design variable in steel material selection. By controlling density the engineering properties of steel components may be altered significantly: improvement in the weight-to-stiffness ratio is particularly pronounced, as is the available energy dissipation and thermal resistivity. Full-scale applications of steel foams in civil structures have not yet been demonstrated. Therefore, existing applications demonstrating either proof-of-concept for steel foam, or full-scale use of aluminum foams in situations with clear civil/structural analogs are highlighted. Adoption of steel foam relies on the manufacturing method, particularly its cost, and the resulting properties of the steel foam. Therefore, published methods for producing steel foam are summarized, along with measurements of steel foam structural (modulus, yield stress, etc.) and non-structural (thermal conductivity, acoustic absorption, etc.) properties. Finally, existing models for predicting foamed steel material properties are summarized to highlight the central role of material density. Taken in total the existing research demonstrates the viability of steel foams for use in civil/structural applications, while also pointing to areas where further research work is required.

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* Corresponding author at: 208 Latrobe Hall, 3400 N. Charles St., Johns Hopkins University, Baltimore, MD 21218, USA. Tel.: +1 410 516 6265.
 E-mail address: schafer@jhu.edu (B.W. Schafer).