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B.R. Bharath Kumar, Mrityunjay Doddamani, Steven E. Zeltmann, Nikhil Gupta, M.R. Ramesh, Seeram Ramakrishna

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B. R. Bharath Kumar[1], Mrityunjay Doddamani[1]*, Steven E. Zeltmann[2], Nikhil Gupta[2], M. R. Ramesh[1] and Seeram Ramakrishna[3]

[1]Lightweight Materials Laboratory, Department of Mechanical Engineering, National Institute of Technology Karnataka, Surathkal, India, *Tel.: +91 9448920878,
Email: mrdoddamani@nitk.edu.in

[2]Composite Materials and Mechanics Laboratory, Mechanical and Aerospace Engineering Department, Tandon School of Engineering, New York University, Brooklyn, NY 11201 USA,
Email: ngupta@nyu.edu

[3]Center for Nanofibers & Nanotechnology, National University of Singapore, Singapore

Abstract

Rapid production of high quality components is the key to cost reduction industrial applications. The present work is the first attempt of manufacturing syntactic foams, hollow particle filled lightweight composites, using an industrial scale injection molding machine. High density polyethylene (HDPE) is used as the matrix material and fly ash cenospheres are used as the filler. Development of syntactic foams with cenospheres serves dual purpose of beneficial utilization of industrial waste fly ash and reduction in the cost of the component. The pressure and temperature used in injection molding process are optimized to minimize fracture of cenospheres and obtain complete mixing of cenospheres with HDPE. The optimized parameters are used for manufacturing syntactic foams with 20, 40 and 60 wt.% cenospheres. With increasing cenosphere content, density and strength reduce and modulus increases. Surface modification of constituents results in rise in strength with increasing filler content. A theoretical model based on a differential scheme is used to estimate the properties of cenospheres by conducting parametric studies because of inherent difficulties in direct measurement of cenosphere properties. The potential for using the optimized injection molding process is demonstrated by casting several industrial components.

Keywords: Syntactic foam; injection molding; theoretical modeling; high density polyethylene; fly ash cenosphere.