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Experimental determination of compressive properties and fracture characteristics of syntactic foam

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Abstract

Syntactic foams are hollow particle-filled polymer composites. In this study, syntactic foams are fabricated by varying the volume fraction and density of microballoons. Three-point bend tests and monotonic compressive strength tests are conducted on foam samples to determine both their fracture toughness values and compressive strength properties. From the fracture characterization tests, the results show that the syntactic foam samples failed in a brittle manner under tensile mode at lower microballoon volume fractions. At higher microballoon volume fractions the samples showed failure in both compressive and tensile regions. It is found that fracture toughness decreases with increase of the microballoon volume fraction and the fracture toughness increases with the increase of microballoons density. Scanning electron microscopic observations are taken to determine the fracture features for all types of syntactic foams. The results from the second part of the study i.e., compressive strength testing indicate that the compression strength of the specimen increases or remains stable for microballoon volume fractions of 20-30% levels. As the microballoon volume fractions increases the compression strength decreases as the volume fractions increases from 40-60%. An increase in the density of microballoons at each volume fractions increases the compressive strength. As the microballoon volume fractions increases the distance between microballoons in the matrix decreases, which increases the interaction between microballoons and the propagation of energy, resulting in the decrease of the strength.

Key words: *Syntactic foam, Compressive strength, Fractures toughness of syntactic foam, SEM of syntactic Foam, Micro-balloons, Solid and hollow micro-beads*

1. Introduction

Composite materials have high strength to weight ratio, high bending stiffness, excellent corrosion resistance and fatigue properties comparable to metals, and also have excellent thermal insulation properties. The uses of syntactic foams in composite structures have expanded exponentially over the last two decades. Syntactic foams offer several of the above mentioned properties (Bunn and Mottram, 1993; Bardella and Genna, 2001) which could be used in our advantage to design new structures. Syntactic

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