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EXPERIMENTAL INVESTIGATIONS ON ENERGY ABSORPTION CHARACTERISTICS OF SYNTACTIC FOAM-CORED SANDWICH COMPOSITES

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Abstract

Syntactic foams are composite materials synthesized by dispersing hollow microspheres in a polymeric matrix. Syntactic foams have gained immense importance as a lightweight and damage-tolerant material when used in foam-cored sandwich structures. This work focuses on the energy absorption capability of three different types of syntactic foam-cored sandwich structures. The main difference between three types of syntactic foam-cores was the type of resin impregnated paper honeycomb structure infused in it. The structure developed from Nomex paper and Kraft paper. Developed foams cores were additionally strengthened by providing E-glass/epoxy face-sheets. Sandwich composites were then conditioned before being cut to required dimensions as per ASTM standard. Sandwich composite coupons were subjected to low-velocity impact test using an Instron Dynatup 8250 drop weight impact testing machine at two different energy levels. Impact responses such as peak impact load, energy absorption and damage modes were evaluated in terms of core stiffness of sandwich structures. Also, a dimensionless parameter - ductility index was evaluated, which is found useful for ranking the impact performance of different sandwich composite under similar testing conditions. Results of the study indicate that, with the infusion of resin impregnated paper honeycomb structure in syntactic foam-cored sandwich composites, the resistance to damage initiation and propagation has improved. Energy is dissipated primarily through damage initiation and then through damage propagation. The improved energy dissipation characteristics of the stiffened syntactic foam-cored sandwich composite promise its applications in stiffness critical safety structures.

Key Words: Sandwich, Syntactic foam, Paper Honeycomb core, Energy dissipation.

1. INTRODUCTION

Composite sandwich panel offer high strength, higher modulus and lower density. This is of utmost important in many applications such as aerospace, marine and automotive structures. Depending on whether the structural design is strength-critical or stiffness-critical, the material used should therefore have a high strength-to-weight ratio or a high stiffness-to-weight ratio.

Sandwich composites are produced by attaching two thin but stiff skins to a lightweight thick core. Some of the commonly used core materials are balsa, honeycomb, corrugated structures, polymeric foams and syntactic foams. The skins are normally made from FRP composites, metal sheets etc. Syntactic foam based sandwich composites are being used in various marine components and structures because of its versatile characteristics. Syntactic