Dynamic mechanical analysis of hybrid composite laminate reinforced with glass/carbon fiber

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Abstract

Composite materials possess the characteristics of high stiffness and high fatigue strength, which are desirable for advanced aircraft components. However, the mechanical behavior of such materials depends upon a variety of factors such as fiber volume fraction, percentage of voids, lay-up order and reinforcement type, the effects of which are difficult to establish individually. As the damage initiates in composite materials and grows during static and cyclic loading, material properties such as modulus, residual strength and strain would vary and, in many cases, they may be significantly reduced because of the progressive accumulation of cracks and delaminations. The objective of the current study was to gain a better understanding of mechanical and dynamic mechanical properties of hybrid composite laminate reinforced with glass woven fabric, carbon woven fabric and epoxy matrix, manufactured using vacuum assisted resin molding process. Quasi-static flexural and dynamic mechanical analysis (DMA) tests were conducted on hybrid composites samples prepared according to ASTM standards. Responses of carbon/epoxy and glass/epoxy laminates were also investigated to compare with that of hybrid samples as a function of fiber content. The storage modulus (E') was found to decrease with temperature in all cases at an oscillating frequency of 1 Hz, and hybrid composite had showed better values of E' at glass transition temperature (Tg=96°C). Microscopic examinations indicated that flexural failure was mainly due to matrix cracking, shear failure of fiber/matrix interface and delamination.