Influence of the high intensity pulsed electric field on the impact response of carbon fiber reinforced composites

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ABSTRACT

In this study, low velocity impact response of carbon fiber polymer matrix plates in the presence of a high intensity pulsed electric field is studied. A new fully automated experimental setup was developed that allows for real time measurements of pulsed electric current, voltage, load, and velocity during coordinated application of a current pulse with an impact load on a carbon fiber polymer matrix composite laminates. The experimental setup included a custom-built current pulse generator that utilizes a bank of capacitor modules capable of producing a 30 ms current pulse with an amplitude of up to 2500 A. The application of the peak of the current pulse was coordinated with the peak of the impact load. A series of electrical, impact, and coordinated electrical-impact characterization tests were performed on 16-ply IM7/977-2 and 32-ply IM7/977-3 unidirectional and symmetric cross-ply carbon fiber polymer matrix composites. From the coordinated impact tests, it was found that the impact load and absorbed energy increased with the application of a current pulse on 32-ply unidirectional specimens. For 16-ply cross-ply specimens, the peak load and absorbed energy decreased slightly with the application of a current pulse because of arcing and burning evident at the edges of the 16-ply cross-ply specimens.