

## **Lightning damages in glass fiber-epoxy composite material used for aerospace applications**

### **ABSTRACT**

Arcing effects, such as that due to lightning, on glass fiber reinforced epoxy composite laminate used in aerospace applications, have been studied. Lightning voltage impulses (1.2/50 micro seconds) were applied at breakdown voltage on the specimens and the arc points were inspected nondestructively using an Ultrasonic Propagation Imaging (UPI) system. The data acquired were processed using the Statistically Thresholded Anomaly Mapping (STAM) method. The outcomes depict that the size of lightning penetration damage is proportional to the breakdown voltage and significantly larger than the charring mark at the point of breakdown. Specimens subjected to surface flash-over reconfirms that whereas the arc leaves little or no visual sign on the specimen surface, there may be significant degradation of the material at microscopic scale. Inspection of 3-layer laminates reveals that the arc damage is characterized by larger charred region, exposed glass fibers due to vaporization of epoxy matrix, and delamination. The delamination could happen for the first ply, the third ply, or both at the same time. The size of the delaminations estimated from STAM image was smaller than those estimated using backlight illumination.

**Keyword:** Glass fiber; Composites; Lightning; Arc; Aviation; Drone