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## **Coupled Thermal-Electrical Simulation Analysis for Carbon Fiber Composites Exposed to Lightning Current Impulse Based on Deleting Cell Process**

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Carbon fiber reinforced composite materials are widely employed on aircraft because of its superior structural and weight performances. Carbon fiber composites possess a much lower electrical conductivity as compared to traditional metallic materials, which lead to serious damage when subject to lightning strike. In order to protect the carbon fiber composites, metallic mesh are used to cover the materials. While the lightning strike damage mechanism of metallic mesh protected carbon fiber composite panel is not explicit, which demands further research. In this paper, simulated lightning current impulse was employed to strike on copper mesh protected carbon fiber composite specimens. Then ultrasonic detection was applied to inspect the damage characteristics of tested composite panels. Based on deleting cell process, coupled thermal-electrical simulation model of carbon fiber composites exposed to simulated lightning strike was established, and lightning current impulse damage mechanisms of composite specimens was discussed. Furthermore, Considering the electrical conduction of carbon fiber composites following its temperature was revealed to be a key parameter for accurate numerical simulation, a modified simulation model was established. The modified model utilize a hypothesis of the electrical conductivity of carbon fiber is inversely proportional to its temperature from decomposition to sublimation. In order to further reveal the damage mechanisms of carbon fiber reinforced composite materials caused by the lightning strike, comparisons were conducted between the numerical simulated results and the experimental results. Research results showed that assume negative correlation between the electrical conductivity of carbon fiber and its temperature from decomposition to sublimation acquire reasonable numerical results, joule heats generated by lightning current was main factor lead to lightning strike damages of carbon fiber composite panels. The research is helpful for understanding the complicated damage phenomena caused by lightning strike, and optimize lightning strike protection for carbon fiber composites.

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