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复合材料层合板雷击烧蚀损伤模拟

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Simulation of Ablation Damage of Composite Laminates Subjected to Lightning Strike

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摘要

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摘要

为解决复合材料层合板的雷击烧蚀问题,通过复合材料层合板雷电流烧蚀的热-电-结构耦合分析,建立复合材料层合板烧蚀的三维有限元模型。利用删除单元法模拟复合材料层合板在不同脉冲波形雷电流作用下的冲击响应,进行复合材料层合板雷击损伤机理和损伤模式分析,得出了复合材料层合板在不同脉冲波形和峰值雷电流作用下的瞬态热传递和热烧蚀规律。分析了不同雷电流参数对烧蚀结果的影响。结果表明峰值电流、放电量和比能对复合材料层合板的烧蚀尺寸和内部损伤产生很大的影响。

关键词: 删除单元法 雷击 复合材料 损伤 烧蚀

Abstract:

In order to study the issue of lightning ablation of composite laminates, a three dimensional finite element model of composite laminate ablation is constructed through a coupled thermal-electrical-structural analysis of composite laminates subjected to lightning strike. Lightning strike responses of different impulse waveforms of composite laminates are simulated through element deletion method. The damage mechanism and damage pattern of composite laminates subjected to lightning strike is analyzed. The mechanism of the transient heat transfer and heat decomposition of composite laminates subjected to lightning strikes of different impulse waveforms and different peak currents is demonstrated. The influence of different lightning parameters on ablation results is analyzed. The results show that the ablation size and inner damage of the composite laminate is influenced greatly by the peak current, electrical charge and action integral of the lightning strike.

Keywords: element deletion method lightning strike composites damage ablation

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