

Accepted Manuscript

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PII: S0263-8223(18)32469-3

DOI: <https://doi.org/10.1016/j.compstruct.2018.08.043>

Reference: COST 10093

To appear in: *Composite Structures*

Received Date: 21 July 2018

Accepted Date: 17 August 2018



Please cite this article as: Dong, Q., Wan, G., Ping, L., Guo, Y., Yi, X., Jia, Y., Coupled thermal-mechanical damage model of laminated carbon fiber/resin composite subjected to lightning strike, *Composite Structures* (2018), doi: <https://doi.org/10.1016/j.compstruct.2018.08.043>

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**Coupled thermal-mechanical damage model of laminated carbon fiber/resin
composite subjected to lightning strike**

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Abstract:

The degradation model of stiffness matrix containing thermal-mechanical coupling damage was constructed by the user-defined subroutine VUMAT on the basis of continuum damage mechanics (CDM) and phenomenological analysis method, then, it was introduced to the software ABAQUS/Explicit to simulate the damage caused by lightning induced effects of thermal ablation and expansion on carbon fiber reinforced polymer (CFRP) laminates. The results revealed the evolution of the coupling damage from the analysis of stress-strain state and damage variables involved. It can be concluded that the thermal-mechanical coupling model pushed the simulated in-plane damage much closer to the experimental results than thermal ablation model, and the good consistency of simulated in-depth damage and experimental results indicated that the lightning induced in-depth damage was mainly brought from the combined impacts of thermal ablation and expansion.

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