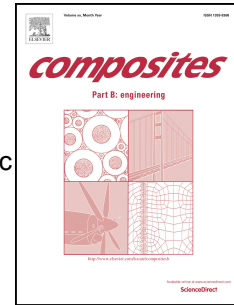


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Thermal stability and ablation resistance, and ablation mechanism of carbon–phenolic composites with different zirconium silicide particle loadings

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Abstract

ZrSi₂ modified carbon–phenolic (C-Ph) composites are prepared using different weight loadings of zirconium silicide particle by compression moulding. The thermal stability and ablation resistance of composites are investigated by thermal gravimetric analysis (TGA) and oxyacetylene torch test. Moreover, the phase composition and microstructure of ablated surface are characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), transmission electron microscopy (TEM) and selected-area electron diffraction (SAED). The results show that introduced ZrSi₂ particles result in an evident increase in the residual weights of C–Ph composites at high temperatures, and the enhancement in thermal stability under air atmosphere exhibits positive effects on improving the ablation resistance of C-Ph composites. The optimum ZrSi₂ weight loading for the improvement of ablation resistance in C-Ph composites is 5wt%. The linear and mass ablation rates of composites after modifying with 5wt% ZrSi₂ particles are reduced by 80.5% and 55.2%, respectively. This work provides an effective way to prominently improve the ablation performance of C–Ph composites, and it may become a backbone of thermal protection system in aerospace.

Keywords:

- A. Polymer-matrix composites (PMCs);
- B. Thermal properties;
- D. Thermal analysis;

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