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LOW DENSITY ABLATIVE MATERIALS MODIFIED BY NANOPARTICLES ADDITION:

MANUFACTURING AND CHARACTERIZATION

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ABSTRACT

Ablative materials represent a traditional approach to thermal protection adopted to protect re-entry space vehicles from the severe heating encountered during hypersonic flight through planet or Earth atmosphere. In this paper low density carbon-phenolic ablative materials were modified with addition of ZrO₂ nanoparticles with the aim of improving the mechanical properties and the ablation resistance. It is known that an uneven distribution of nano-reinforcement could be responsible for a drastic limitation of potential beneficial effects. For this reason, several surface modification treatments were performed on nanoparticles to limit their agglomeration. The developed ablative materials, modified with different concentrations of nano-ZrO₂ particles, were fully characterized for microstructure and mechanical properties (of both virgin and charred materials) and finally tested in an oxyacetylene torch-based facility to compare their thermal performance. Experimental evidence showed that the addition of nano-ZrO₂ produces an improvement of both thermal and mechanical performance with respect to base material.

KEYWORDS

Nanocomposites; Nanoparticles; Ablative materials.

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