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Innovative ablative fire resistant composites based on phenolic resins modified with mesoporous silica particles

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ABSTRACT

Mesoporous silica particles were used as reinforcement of a phenolic resin to develop new ablative materials. A resol type phenolic resin was filled with mesoporous silica particles synthesized from tetraethyl orthosilicate (TEOS). Samples of neat phenolic resin, phenolic resin reinforced with carbon black and with mesoporous silica particles (5 and 20 wt. %), were obtained. The ablative properties of the materials were studied by the oxyacetylene torch test and the ablated samples were observed by scanning electron microscopy (SEM). The composites were also characterized by dynamic mechanical analysis and transmission electron microscopy (TEM). Results showed a stronger chemical interaction between silica particles and the phenolic resin, than carbon black, thus increasing the glass transition temperature and mechanical properties of the silica/resin composites. In addition, the samples with mesoporous silica particles achieved lower erosion rates and back-face temperatures than the others, becoming promising thermal protection materials for the aerospace industry.

Keywords: Silica particles, Phenolic resin, Composite materials, Ablative materials, Thermal protection system.

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