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Thermal, Thermo oxidative and Ablative behavior of cenosphere filled ceramic/phenolic composites

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Abstract

Cenosphere filled ceramic/phenolic composites were prepared and their thermal, thermo oxidation and ablative behavior were studied by Thermogravimetric Analysis (TGA) and oxyacetylene ablation test. Classical thermal stability parameters, based on initial decomposition temperature and mass loss at various temperatures were calculated before and after subtraction of cenosphere content from the TGA curves. The result shows that the thermal stability of the filled composites seems to be improved and reduction of mass loss was achieved with addition of cenosphere. The characteristic temperature differences (ΔT) were calculated from TGA curves to study the effect of cenosphere on thermo oxidation behavior of the filled composites. Ablation parameters such as linear ablation rate, mass ablation rate and back face temperature profiles were investigated. Ablation results showed that the addition of cenosphere content exhibits the favorable ablation resistance.

Keywords: Thermal behavior, Ablative behavior, Thermo oxidative behavior, Thermogravimetric analysis (TGA), Cenosphere, Phenolic resin, Ceramic Fibre

1. Introduction

Composite based ablative material plays an important role in the aerospace industry. Mainly ablative materials are used in Thermal Protection System (TPS) which protects the aircrafts and space probes during hypersonic flight through a planetary atmosphere. Ablative materials provide thermal insulation by ablation process. Ablation process is a thermochemomechanical phenomenon which provides thermal insulation through the