

# ABLATIVE AND THERMAL PROPERTIES OF CARBON/PHENOLIC NANOCOMPOSITES

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This research is dedicated to a potential material for ablative applications which could be alternative for currently used materials. Ablation is a process of material removal from a surface or other erosive process, and usually associated with materials for space reentry vehicles and rocket nozzles. The ablatives are placed on the surfaces of rocket, space vehicles, and combustion chambers of rocket engines in order to ensure suitable temperature conditions for operations. These materials should withstand very high temperatures in the order of thousands of degrees Celsius, high thrust, high friction, and impact. The material should be able to shape complex shapes and should be as light as possible. Ablative materials have progressed with introduction of new materials and technologies. Since late 1990, nanotechnology has been a new frontier of all scientific community. Nanotechnology deals with particles which have at least one dimension less or equal to 100 nm. Addition of proper nanoparticles in polymer matrix can enhance ablative and overall mechanical properties of polymer matrix composites. Therefore, many articles and reports have been published on effects of nanoparticles on ablative properties (1,2,4,5,6). The typical nanoparticles used for ablatives are Single and Multi Wall Carbon Nano Tubes (SWNT, MWNT), carbon black, different nanoclays. The major goal of this study is to evaluate the effects of multi-walled carbon nanotubes (MWCNT) on ablation properties of carbon/phenolic nanocomposites. MWCNT will be blended into phenolic resin using high-shear mixing technique to ensure exfoliation of nanoparticles. Loadings of 0, 1, 2, and 3wt% of MWCNT will be dispersed in the phenolic resin. Test panels of 120 x 120 x 12.6 mm carbon reinforced composites will be manufactured from prepreps using compression molding. Test specimens will be cut into proper size by using abrasive water-jet cutting. Preliminary studies were conducted using radiant heat panel at heat flux of 15 kW/m<sup>2</sup>. These results demonstrated promising results. Further, Simulated Solid Rocket Motor (SSRM) testing facility will be used to examine ablative properties of these phenolic-MWCNT nanocomposites with flame temperature about 2,200°C.

## References:

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