

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Poster Session (P)

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ABLATIVE PERFORMANCE COMPARISON STUDY OF LIGHTWEIGHT AND DENSE 3D
CARBON FABRIC COMPOSITES**Abstract**

Lightweight and dense 3D carbon fabric composites with phenolic matrix have been fabricated for investigation of the ablative properties. A low-density rigid carbon fibrous preform, which was vacuum molded by chopped carbon fibers and binders, was used as substrate in lightweight carbon/phenolic composite. A 3D pierced carbon fiber fabric with high fiber volume content was used as substrate in dense carbon/phenolic composite. The microstructure of lightweight composite was characterized by SEM, which showed nanoporous/microporous structure in composite. The ablation and thermal performance of composites in hypersonic flow environment were determined by arc jet test carried on heat flux of 600 W/cm². Recession rate of dense composite was much lower compared with lightweight composite. However, the discrepancy in in-depth temperature responses and ablative end-stated of composites clearly indicated that lightweight composite exhibited excellent thermal insulative properties due to high porosity as well as high surface area of phenolic matrix. The lightweight composite had higher effective heat of ablation than dense one on test conditions.