IMAGING AND 3-D MODELING OF PITCH BASED CARBON FOAMS

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Graphitic carbon foams are a new class of cellular materials wherein the intrinsic properties of the carbon approach those of high stiffness pitch-derived graphitic carbon fibers. These foams have very attractive thermal and structural properties, with a range of multifunctional applications including heat exchangers and composite/foam core sandwich structures. A knowledge of the three dimensional microstructure and morphology of the foam is critical to understanding their thermal and mechanical behaviors. Robo-Met.3D is a tool, recently developed by the Air Force Research Laboratory Materials and Manufacturing Directorate and UES, Inc. for automated serial sectioning & imaging, and three dimensional reconstruction. Using Robo-Met.3D, the three dimensional structures of graphitic foams from several producers are established including pore geometry, surface area and defect density. These structures are then analyzed using finite element modeling to simulate their thermal transport properties and mechanical behavior. These results are then compared to properties measured experimentally. This research is part of a larger effort to characterize heterogeneous microstructures using complex systems approaches. To this end, a limited analysis of the statistical variability of the microstructural features is also presented.

Key words: carbon, foam, microstructure