Multifunctional Carbon Foams for Aerospace Applications

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Carbon foams produced by the controlled thermal decomposition of inexpensive coal extracts exhibit a combination of structural and thermal properties that make them attractive for aerospace applications. Their thermal conductivity can be tailored between 0.5 and 100 W/mK through precursor selection/modification and heat treatment conditions; thus, they can serve in either thermal protection or heat transfer systems such as heat exchangers. Because their structure is essentially a 3D random network of graphite-like members, they also can be considered low-cost, easily fabricated replacements for multi-directional structural carbon fiber preforms. Strengths of over 4000 psi in compression are common. Their density can be designed between 0.1 and 0.8 g/cm^3, and they can be impregnated with a variety of matrices or used, unfilled, in sandwich structures. These foams also exhibit intriguing electrochemical properties that offer potential in high-efficiency fuel cell and battery applications, mandrels and tooling for composite manufacture, ablative performance, and fire resistance.

This paper presents the results of research conducted under NASA SBIR Topic 99.04.01, General Aviation Technology, supported from Langley Research Center. The potential of foam design through precursor selection, cell size and density control, density grading, and heat treatment is demonstrated.