Lightweight, High-Temperature Radiator for Space Propulsion

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For high-power nuclear-electric spacecraft, the radiator can account for 40% or more of the power system mass and a large fraction of the total vehicle mass. Improvements in the heat rejection per unit mass rely on lower-density and higher-thermal conductivity materials. Current radiators achieve near-ideal surface radiation through high-emissivity coatings, so improvements in heat rejection per unit area can be accomplished only by raising the temperature at which heat is rejected. We have been investigating materials that have the potential to deliver significant reductions in mass density and significant improvements in thermal conductivity, while expanding the feasible range of temperature for heat rejection up to 1000 K and higher. The presentation will discuss the experimental results and models of the heat transfer in matrix-free carbon fiber fins. Thermal testing of other carbon-based fin materials including carbon nanotube cloth and a carbon nanotube composite will also be presented.

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