Simultaneous Measurement of Conductive and Radiative Properties of SiC Foam at Temperatures up to 1200 K by Inverse Method

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SiC ceramic foam is extensively applied in the areas of thermal protection system, solar radiation absorber and porous burner, etc., because of its excellent thermal, mechanical, optical and anti-oxidation performances. The heat transports with ceramic foams include not only conduction through both solid and gaseous phases and gas convection residing in the foam pores, but also radiation. In its high temperature applications, thermal radiation dominates the heat transfer within the foam. However, limited thermal radiative properties are available, which make detailed thermal radiation analysis quite difficult. In this paper, a conductive/radiative coupled heat transfer model was developed based on radiation transfer equation and energy conservation equation for SiC ceramic foam. In combination with transient thermal distribution measurements, a simultaneous estimation of equivalent thermal properties was carried out in different temperature intervals for SiC foam by inverse method. The temperature-dependent conductive and radiative properties (i.e. extinction coefficient, albedo of scattering and linear coefficient of phase function, and conductive thermal conductivity) at temperatures up to 1200 K were obtained and discussed. The proposed analysis method provides a powerful tool for simultaneous measurements of the thermal properties at high temperatures for foams.