Vol. 12, No. 4, 2003

Measurement of Thermal Diffusivities during Self-propagating High-temperature Synthesis

D. Vrel, N. Karnatak, E.M. Heian, S. Dubois, and M.-F. Beaufort

Laboratoire d'Ingénierie des Matériaux et des Hautes Pressions, UPR 1311 CNRS, 99 avenue J.-B. Clément, 93430 Villetaneuse, France
Laboratoire de Métallurgie Physique, UMR 6630 CNRS-Université de Poitiers, Bât. SP2MI, BP 30179, Bd M. et P. Curie, 86962 Futuroscope Cedex, France
GFA, GDR 2391SC CNRS, c/o J.-C. Niepce, LRRS, BP 47870, 21078 Dijon, France

Combustion synthesis (SHS) of ceramics induces strong temperature gradients in samples. The observation of relaxation of temperature gradients within a sample before or after an SHS reaction allows thermal diffusivity to be estimated. A numerical routine to optimize diffusivity and heat losses simultaneously is used to minimize the difference between a calculated temperature profile based on an earlier measured profile and the actual temperature profile measured at a given time. Temperature profiles are captured with and infrared camera.
This method yielded a value close to 1.0 x 10^{-6} m^2s^{-1} for two porous TiC samples. For a compacted mixture of Ti and C powders, the thermal diffusivity is found to have a strong variation with temperature, and values from 4.6 x 10^{-7} m^2s^{-1} at 500°C to 4.5 x 10^{-6} m^2s^{-1} at 700°C were calculated.