**Vol. 13, No. 1, 2004**

# Effect of Nanostructured Reactants on TiC Combustion Synthesis and Microstructure

**E. M. Heian[1], N. Karnatak[1], D. Vrel[2], M. F. Beaufort[1], and S. Dubois[1]**

[1] ***Laboratoire de Métallurgie Physique (UMR 6630), Bât. SP2MI, Bd M. & P. Curie, BP 30179, 86962 Futuroscope-Chasseneuil du Poitou, France***
[2]***Laboratoire d'Ingéniérie des Matériaux et des Hautes Pressions, UPR 1311 CNRS - Université Paris Nord, Institut Galilée, 99 Avenue Jean-Baptiste Clément, 93430 Villetaneuse, France***

The adiabatic temperature of titanium carbide is significantly above the melting point of titanium. As a consequence, TiC grains nucleated in the Ti melt during combustion synthesis can easily grow beyond the nanocrystalline regime. To produce nanocrystalline TiC via SHS, it is thus necessary to simultaneously encourage nucleation and reduce grain growth - two often contradictory requirements. In this study, nucleation was enhanced by milling the reactants together in a high-energy SPEX mill. The intimately mixed nanocrystalline clusters thus formed reacted very rapidly at very high temperatures and the resulting product is microcrystalline. To lower the reaction temperature and thus reduce grain growth, methods to encourage heat losses were explored, particularly dilution with an inert material. With the addition of 40 mol% TiC as a diluent, the mechanically activated reactant mixture reacted fully under heat loss conditions that would prevent ignition in a standard mixture. The reaction temperature was greater than 1800°C, but the product grain size was between 50 and 150 nm, as measured by X-ray diffraction analysis and TEM. With the twin techniques of mechanical activation and deliberate heat losses, we were able to control the reaction conditions of TiC and the resulting grain size of the product.