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## **Nanocrystalline TiC Combustion-Synthesized from Nanostructured Reactants and TiC Diluent**

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### **ABSTRACT**

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 both by milling the reactants together in a high-energy SPEX mill and by introducing nanocrystalline TiC as nucleation sites. The dilution with an inert material also serves to lower the reaction temperature and thus reduces grain growth by encouraging heat losses. With the addition of nanocrystalline TiC (25 mol.%) as a diluent, the mechanically activated reactant mixture fully reacts under heat loss conditions that would prevent ignition in a standard mixture. The reaction temperature was in the range 1700-1800K, below Ti melting point, and the SHS end-product was constituted of both nanocrystalline and submicrocrystalline TiC, as measured by X-ray diffraction analysis and TEM.