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Effect of Carbon Addition on High Pressure Combustion Synthesis Between Titanium and Nitrogen

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In a previous work, we studied the synthesis of titanium nitride using self propagating high temperature synthesis. Materials with a dense structure and a nitrogen rate near stoichiometry were obtained. Here we studied the effect of carbon addition on the SHS formation mechanism of titanium nitride. The carbon rate varied between 5 to 33 at % and the reaction nitrogen pressure ranged from 6 to 50 MPa. A decrease in the combustion temperature when the carbon rate increased was observed, which indicated the diluent role of the carbon. An increase in nitrogen pressure led to an increase in combustion temperature. A TiCN solid solution was obtained with the lattice parameter that varied with the carbon rate. The presence of unreacted carbon was detected from a carbon rate of 15 at %. For low carbon rates, the material microstructure was observed to be constituted of a dense bulk structure surrounded by a porous surface layer. When the carbon rate increased, the dense bulk structure progressively disappeared and was substituted by a porous structure. The SHS mechanisms of the TiCN formation were assumed from literature and from these experimental results.