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Effect of Nickel Addition on the Ti-C Reaction Process and Microstructural Evolution by SHS

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ABSTRACT

We studied the synthesis of stoichiometric titanium carbide using SHS, with various additives. Nickel (Ni) has been used, either as a pure powder or as a 3Ni + Al₂O₃ powder mixture. It is incorporated into an equimolar Ti/C reactant mixture, in order to study the effect of the addition on the combustion reaction between titanium and carbon, with a powder granulometry lower than 10µm. The final product was analyzed by X-ray diffraction and scanning electron microscopy. As the amount of nickel incorporated was increased from 0 to 20 wt. % the grain size of TiC decreased to approximately 2µm. It was also observed that most of nickel in TiC-Ni composite was distributed on the surface of almost spherical TiC grains. For the addition of the 3Ni + Al₂O₃ mixture, the ignition time increases with the percentage added, therefore making the SHS reaction of the titanium-carbon system more difficult. The combustion process is therefore directly affected and the propagation mode becomes unstable.

Key words: SHS; titanium carbide; nickel.