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Back to browse issues page Volume 6, Number 1 (winter 2009 2009)

Implementation of Combined Mechanical Activation and Thermal Analysis for Identification of Combustion Synthesis Mechanism in TiO2-Al -C System

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Article abstract:

Abstract:A combination of mechanical activation and Differential Thermal Analysis (DTA) together with X-Ray Diffraction (XRD), and various microstractural characterization techniques were used to evaluate the starting reaction in the combustion synthesis of TiC-Al2O3 composite in TiO2-Al-C system. The mechanical activation was performed on the mixtures of two components of TiO2/Al, Al/C and TiO2/C and then the third component was added according to the stoichiometric reaction for 3TiC+2Al2O3 composite formation. The powder mixtures were heated up to 1450 °C under Argon atmosphere at a heating rate of 10 °C/min. The combustion synthesis temperature was observed to decrease from 962 °C to 649 °C after milling of TiO2/Al mixture for 16 hr. On the contrary, the mechanical activation of Al/C and TiO2/C mixtures for 16 hr made the reaction temperature increase to 995 °C and 1024 °C, respectively. The decrease in reaction temperature as a result of milling the TiO2/Al mixture could be due to an increase of TiO2 and Al interface area as confirmed by TEM micrographs and XRD patterns of milled powder mixture. In addition, DTA experiments showed that for the sample in which TiO2 and Al were mechanically activated the reaction occurred at the temperature even lower than that of Al melting point.

Keywords: TiC+Al2O3; Mechanical activation; Combustion synthesis; Reaction Mechanism

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Back to browse issues page Volume 6, Number 1 (winter 2009 2009)