

عنوان مقاله:

The effect of mechanical activation on the kinetic and formation mechanism of a niobium aluminide based nanocomposite

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خلاصه مقاله:

In this paper the feasibility of $\text{NbAl}_3/\text{Al}_2\text{O}_3$ nanocomposite formation through mechanochemical reaction between Al and Nb_2O_5 and the effect of mechanical activation on the kinetic and reaction mechanism were investigated. Structural and phase evolution during mechanical alloying were studied by employing transmission electron microscopy (TEM), X-ray diffraction (XRD) and differential thermal analysis (DTA) techniques. It was found from the results that the reduction of Nb_2O_5 by Al takes place in an explosive mode and after ۴۵۰ min of mechanical alloying leading to the formation a microstructure consisting of NbAl_3 matrix and nanocrystalline Al_2O_3 particles. The results also showed that heating the as-blended powder mixture of Nb_2O_5 and Al, leads to the formation of $\text{NbAl}_3/\text{Al}_2\text{O}_3$ composite through two exothermic reaction; A thermite reaction at ۸۸۰ °C followed by the synthesis of NbAl_3 intermetallic at ۹۴۴ °C. The mechanical activation of Nb_2O_5 and Al powder for ۵h decreased the formation temperature of $\text{NbAl}_3/\text{Al}_2\text{O}_3$ from ۹۴۴ °C to ۶۲۵ °C. Five isoconversional methods, of Kissinger-Akahira-Sunose, Tang, Flynn-Wall-Ozawa, Starink and Friedman were used to determine the activation energy, E_a , for $\text{NbAl}_3/\text{Al}_2\text{O}_3$ formation reaction and its variation with conversion degree α . The results showed that these methods lead to similar or comparable values of E_a .

کلمات کلیدی:

Nanostructures, Intermetallic compounds, DTA, Kinetic study, Niobium

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