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PII: S0264-1275(16)30081-8
DOI: doi: 10.1016/j.matdes.2016.01.080
Reference: JMADE 1281

To appear in:

Received date: 18 October 2015
Revised date: 16 January 2016
Accepted date: 19 January 2016

Please cite this article as: H. Ahmadian Baghbaderani, M.R. Rahimipour, M. Delshad Chermahini, A combined experimental and modelling study of thermodynamics and kinetics of mechanochemical treatment for synthesis of $Ni_{0.5}Co_{0.5}Fe_2O_4$, (2016), doi: 10.1016/j.matdes.2016.01.080

A combined experimental and modelling study of thermodynamics and kinetics of mechanochemical treatment for synthesis of $Ni_{0.5}Co_{0.5}Fe_2O_4$

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Abstract

A combined experimental and modelling approach has been used to explain thermodynamic and kinetic aspects of mechanochemical treatment to synthesize $Ni_{0.5}Co_{0.5}Fe_2O_4$. After obtaining the desired phase from Fe_2O_3, Co_3O_4 and NiO as precursors via continuous and interrupted mechanochemical routs, the contributions of microstructure changes and temperature rise to total input energy were calculated. The fraction for the former was less than 1% and the remaining energy was lost mostly in the form of heat. Then, a theoretical model for calculation of temperature rise in particles at the point of collision was proposed. Based on the model results, the temperature rise during the continuous condition was higher than the interrupted one's which was verified by lower amount of microstrain, larger grain and particle size of the interrupted milled samples. To evaluate amount of formed phase as a result of the simultaneous effects of temperature rise and microstructure changes, a phenomenological kinetic model was developed. The fairly

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