World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:10, No:06, 2016

Structural and Phase Transformations of Pure and Silica Treated Nanofibrous Al_2O_3

Authors : T. H. N. Nguyen, A. Khodan, M. Amamra, J-V. Vignes, A. Kanaev

Abstract : The ultraporous nanofibrous alumina (NOA, Al2O3·nH2O) was synthesized by oxidation of laminated aluminium plates through a liquid mercury-silver layer in a humid atmosphere ~80% at 25°C. The material has an extremely high purity (99%), porosity (90%) and specific area (300 m2/g). The subsequent annealing of raw NOA permits obtaining pure transition phase (γ and θ) nanostructured materials. In this combination, we report on chemical, structural and phase transformations of pure and modified NOA by an impregnation of trimethylethoxysilane (TMES) and tetraethoxysilane (TEOS) during thermal annealing in the temperature range between 20 and 1650°C. The mass density, specific area, average diameter and specific area are analysed. The 3D model of pure NOA monoliths and silica modified NOA is proposed, which successfully describes the evolution of specific area, mass density and phase transformations. Activation energies of the mass transport in two regimes of surface diffusion and bulk sintering were obtained based on this model. We conclude about a common origin of modifications of the NOA morphology, chemical composition and phase transition.

Keywords : nanostructured materials, alumina (Al_2O_3), morphology, phase transitions
Conference Title : ICNMS 2016 : International Conference on Nanotechnology and Materials Sciences
Conference Location : Copenhagen, Denmark
Conference Dates : June 27-28, 2016