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Understanding Growth Behavior of Alumina (Al_2O_3) and Boehmite (AlO(OH)) Nanoparticles

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Alumina (Al_2O_3 or aluminum oxide) is an important metal oxide used in variety of applications due to its chemical and thermal stability. Nanoscale powders can be useful as an integral ink material used in direct write (robocasting) processes as well as in numerous commercial products such as electronics and paints. Critical to these applications is understanding how Al_2O_3 crystals grow under various processing conditions in order to control its properties. In order to understand growth behavior of Al_2O_3 nanoparticles, the effect of precursor on nanoparticle phase and morphology was examined within solution processing routes. Solution nanoparticle processing routes (e.g., glycothermal, solvothermal, and solution precipitation) were used to lower the temperatures and/or pressures required to reach the α-Al_2O_3. Powders were isolated and examined with X-ray Diffraction and Electron Microscopy. Depending on processing route, wires, plates, or spherical particles of boehmite or alumina were obtained. Full details on the synthesis and characterization on alumina and boehmite will be presented. This work was supported in part by Laboratory Directed Research and Development (LDRD), Department of Energy (DOE), Geothermal Technologies Office (GTO) under the Office of Energy Efficiency and Renewable Energy (EERE), and by the Sandia STAR Program. Sandia National Laboratories, a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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