Issues of Scale: Effects of Microstructural Features on the Thermal Diffusivity of α-Al_2O_3 Prepared from Nanosize γ-$A1_20_3$ Powder

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With the continuing trend towards the miniaturization of devices, stronger emphasis has been given to understanding effects of small microstructural features on thermal properties. Furthermore, the use of thin films in electronic devices has also brought into question size scale effects of features such as film thickness, grain size, grain morphology, porosity, and precipitates. The current research work attempts to % the importance of size scaling issues to develop a fundamental understanding. For example, to study the effects of small and homogeneously distributed porosity in ceramic materials, we have prepared porous specimens using nanosize starting powders. The insulating ability of fine scale porosity in samples of αAl_20_3 in combination with a small grain size has been studied using the photothermal deflection technique. The thermal diffusivity values measured from these samples cannot be described with the classic thermal models available in the literature.