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**A fine-scale nanostructure in  $\gamma$ -alumina**<sup>1</sup> GIANLUCA PAGLIA, EMIL BOZIN, SIMON BILLINGE, Department of Physics and Astronomy, Michigan State University, Biomedical Physical Sciences, East Lansing, MI, 48824-2320 — Despite the preeminent industrial importance of  $\gamma$ -alumina in catalysis, details of the structure remain unresolved due to its 15-30~nm domain nanocrystalline nature. Diffraction patterns are broad and single crystals are not available making accurate structural solution difficult using conventional crystallographic methods. We have applied a local structural technique, the atomic pair distribution function (PDF) analysis of powder diffraction, to obtain a quantitative structure. This is a total scattering technique that incorporates both Bragg and diffuse scattering information in the PDF, allowing all diffracted intensities from the XRD pattern to be equally considered. Surprisingly, we find a previously unknown fine-scale nanostructure with a domain size  $\sim 1$  nm. Within these nanodomains the oxygen sublattice is modified from the average structure and retains aspects of the boehmite precursor. This results in a novel and unexpected view of the  $\gamma$ -alumina structure since earlier controversies about it centered on the arrangement of Al ions among different cation sites, whereas the oxygen sublattice arrangement was not usually questioned.

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