X-ray Line Profile Analysis of CeO_2 Nanoparticles

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Microstrain and crystallite size characteristics of nanomaterials are important as they define the mechanical, optical and electronic properties of the specimen. By characterising these parameters in a test-bed material such as cerium oxide (CeO_2) nanoparticles, complex physical models can be developed to fit experimental X-ray diffraction data. This understanding is crucial for creating complex polytypic structures that can be used to develop more advanced materials and further the already growing nanotechnology industry.

In this paper the X-ray line profile analysis is used to quantify the dislocations and size distribution of CeO_2 nanoparticle samples. The analysis quantifies the density of dislocations, while the crystallite size properties are quantified in terms of size distribution and modal properties of the CeO_2 specimens.

The CeO_2 nanoparticle specimens studied here are bimodal admixes that comprise varying proportions of ~30nm and ~5nm nanoparticles. X-ray line profile analysis is used to quantify the dislocation and size distribution for these samples. These results are compared with experimental TEM measurements of the samples.

Keywords: line-profiles, nanoparticles, dislocations