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Application of the Debye formula to the computation of x-ray diffraction patterns of nanostructured diffusion couples[1] CHARLES CHEUNG, BRIAN KELLY, KARL UNRUH, MATTHEW DECAMP, Department of Physics and Astronomy, University of Delaware — Time resolved optical pump/x-ray probe techniques have made it possible to acquire x-ray diffraction patterns corresponding to very early diffusion times in nanostructured diffusion couples. The analysis of these diffraction patterns, however, is complicated by significant line broadening and other finite size effects that appear in samples containing a relatively small number of scatterers. In order to better quantify these issues, x-ray diffraction patterns have been calculated by the direct application of the Debye formula to core/shell and thin film diffusion couples. In particular a series of diffraction patterns have been calculated as a function of the sample size and composition profile determined from the appropriate solutions to Fick's second law. The results of these calculations have been used to guide the interpretation of the measured diffraction patterns of Pt/Ni core/shell nanoparticles and Pt/Ni thin film multilayers.

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