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Three-Dimensional Lattice Matching for Epitaxially Embedded Nanoparticles BRELON MAY, PETER ANDERSON, ROBERTO MYERS, Ohio State Univ - Columbus — Since Mathews-Blakeslee developed a theory of atomic lattice matched thin films, epitaxy has been modeled using only 2D lattice matching conditions between arbitrary films. For a given degree of in-plane lattice mismatch, the theory predicts a critical film thickness above which interface defects form to relax the film strain. Here we present a three-dimensional model to predict the conditions for epitaxially encased nanoparticles, which includes not only the in-plane lattice matching, but also the out-of-plane mismatch. We find that the consideration of the out-of-plane strain, due to the Poisson effect and particle shape change, can greatly alter the critical volume compared to what the Mathews Blakeslee model predicts. Our results provide new insight to nanoepitaxy of low dimensional structures especially quantum dots and nanoprecipitates.

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