The Effect of Annealing on Cluster Formation

Gonzalez, James (School: duPont Manual High School)

The creation of nanofilm (sheets of nanoclusters) are widely used in many materials today for structural engineering and electronic equipment. Manipulating and observing nanocluster growth in real life is costly and time consuming. The growth of clusters was studied using computer simulations to save time and resources. These programs incorporate four basic atomic processes and one after process: the deposition of adatoms (adsorbed atoms), diffusion, nucleation, growth of clusters, and thermal annealing. Annealing is the process of heating clusters of atoms to create a probability of atoms breaking off clusters. Annealing follows the rule of Ostwald Ripening, where smaller clusters are absorbed into larger clusters. Different temperatures and their roles have been identified. Furthermore, both size and spatial distributions of clusters before and after annealing were studied using histograms and pair-correlation functions, and the characteristic of the distributions were analyzed. Results found that higher annealing temperatures increased cluster density. Clusters were found to be much more compact (little to no branching). The average distance between clusters increased. Comparison of simulation results with experimental scans support simulation validity. Potential applications of nano-engineering will also be discussed.

Awards Won: