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Size control of thiol-stabilized gold nanoparticles[1] I. PISTER, L. SOUSSAN, S. NEMZER, T. HARRIS, A.I. FRENKEL, Yeshiva University, Y. SUN, M.H. RAFAILOVICH, SUNY Stony Brook — The goal of this research was to investigate the possibility to control the size of the thiol-stabilized gold nanoparticles by a gold/thiol ratio. Several samples of gold nanoparticles stabilized by dodecanethiol chains were prepared by using two different ("one phase" and "two phase") methods. For each method, the only difference between the seven samples analyzed was the gold/thiol ratio. The samples were analyzed by Extended X-Ray Absorption Fine Structure (EXAFS) and Transmission Electron Microscopy (TEM). The results demonstrate that as the gold-thiol ratio decreases, the average size of the particle decreases as well. Surprisingly, we obtained that at the values of the gold/thiol ratio less than 1:2, the cluster size stabilizes. The smallest clusters were obtained by EXAFS analysis to be cuboctahedral in shape where Au atoms occupy close packed structure positions. The average size of the clusters was ca. 11 Å, corresponding to a 55 atom regular cuboctahedron. Due to a finite distribution of sizes obtained by TEM, we conclude that the significant amount of clusters were the 13 atom clusters, i.e., the smallest possible regular polyhedral clusters. This result explains why the further decrease of the Au/thiol ratio (below 1:2) does not change the average cluster size. Another factor contributing to the stabilization of the nanoparticle size at small Au/thiol ratio is the steric repulsion of thiol chains.

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