Morphologies of Ag clusters grown in superfluid helium nanodroplets

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Silver nanocluster (Ag_n) were synthesised in superfluid helium nanodroplets (He_N) and subsequently deposited on an amorphous carbon (a-C) surface. Transmission electron microscope (TEM) images and high resolution TEM (HRTEM) images, revealing the cluster size distribution and the cluster morphology, shall be presented.

Helium nanodroplets combine both, a least perturbing superfluid quantum matrix at 0.4 K and a well-defined local confinement, given by the droplet radius of a few nanometers [1]. These unique experimental conditions led to an extensive use of He_N in spectroscopy during the past decade [2] and made them also interesting for the purpose of cluster synthesis.
Only recently clusters assembled in He_N were deposited on a surface [3], leading to increasing interest on this cluster production method. However, little is known so far about the fundamental cluster formation process inside He_N.
We are able to present for the first time a detailed study of the distribution of different cluster morphologies grown in superfluid droplets. Ag_n were assembled in He_N and subsequently deposited on either the a-C surface of commercial TEM grids or on a microbalance. While the Ag_n size distribution could be extracted from TEM images, the comparison of the latter with measured deposition rates yields information about the sphericity of the clusters.
HRTEM images showed that the Ag_n adopt decahedral, icosahedral and fcc structures. A comparison of the data with inert gas aggregation (IGA) experiments [4] and corresponding theoretical work [5] allows us to give possible growth mechanisms that might lead to the observed structures.
We further seek to present first results from currently performed molecular dynamic (MD) simulations on the same topic.

References:

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