Stereochemistry of Ultrasmall Gold Nanoparticles

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Ultrasmall monolayer-protected gold nanoparticles show an intriguing stereochemistry. This is due to the molecular properties of the nanoparticles (or clusters) in the size regime below 2.5 nm (corresponding to several tens of metal atoms). The clusters can be either protected by chiral ligands or intrinsically chiral, as revealed by x-ray crystallography. (1) The separation of the enantiomers of defined gold clusters protected in achiral ligands and their Circular Dichroism properties are discussed. (2) Experimental results are compared to simulated spectra, allowing for deeper insight into the electronic structure of the clusters or their structural prediction. Racemization studies indicate high flexibility of the gold-thiolate interface. (3) The influence of single chiral ligands on the CD spectra of the clusters was investigated, too. It was found that bidentate ligands effectively suppress the racemization of the clusters, which may be of use in future applications.

Stefan Knoppe studied chemistry at the Universities of Kiel and Heidelberg and obtained his PhD under the guidance of Prof. Thomas Bürgi at the University of Geneva (2012). He is currently a postdoctoral fellow in the group of Prof. Verbiest at KU Leuven where he studies the nonlinear optical properties of ligand-protected metal clusters. He received the Umicore Materials Technology PhD Award 2015 (EUR 10,000).

References