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Nanocrystal Arrays and High Pressure Surface Plasmon Spectroscopy

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Abstract

Nanotechnology is about using single nanoscale objects in devices and applications. Yet there are still few ways to reliably manipulate and position single nanocrystals with nanometre spatial resolution. In the first part of this talk, I will discuss the positioning of single nanocrystals into arrays using several different assembly methods. A key question is whether one can assemble nanocrystals using chemical forces or whether it is better to use applied fields to drive assembly. We show that electrophoresis, the movement of particles in an applied DC electric field, is a valuable tool for single nanocrystal manipulation.
In the second part of the talk, I will present data on the effects of hydrostatic pressure on gold particle spectra. This work was carried out with Prof. Fernando Rodriguez at Santander University, Spain. We show that the spectrum can be used to measure the bulk modulus of gold particles, and this is somewhat higher than for bulk gold. We also show that phase transitions in the solvent can be detected and the solvent parameters associated with new phases determined under pressure.

References

1. Heyou Zhang, Calum Kinnear, and Paul Mulvaney. “Fabrication of single-nanocrystal arrays”, Advanced Materials, Art. 1904551, (2019).
2. Heyou Zhang, Jasper Cadusch, Calum Kinnear, Timothy James, Ann Roberts, and Paul Mulvaney. “Direct assembly of large area nanoparticle arrays”, ACS Nano, 12, 7529–7537, (2018).
3. Camino Martín-Sánchez, José Antonio Barreda-Argüeso, Susanne Seibt, Paul Mulvaney, and Fernando Rodríguez; “Effects of Hydrostatic Pressure on the Surface Plasmon Resonance of Gold Nanocrystals”, ACS Nano 13, 498−504 (2019).
4. Camino Martín-Sanchez, Ana Sanchez-Iglesias, Paul Mulvaney, Luis M. Liz-Marzan, and Fernando Rodríguez; “Plasmonic Sensing of Refractive Index and Density in Methanol−Ethanol Mixtures at High Pressure”, J. Phys. Chem. C 124, 8978−8983 (2020).