SPECTROSCOPIC ELLIPSOMETRY ANALYSIS OF SELF-ASSEMBLED AU/PNIPAM CORE-SHELL NANOPARTICLES

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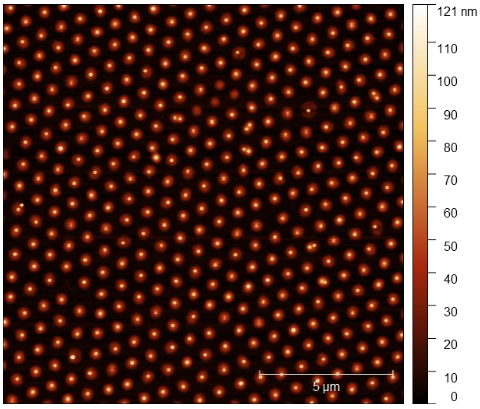

The ordered assembly of nanoparticles is a key challenge in nanoscience. A convenient approach in this regard is to use self-assembly methods, that allow to create ordered arrays of nanoparticles on a relatively large scale (cm^2) and at a low cost [1]. Such platforms of uniformly-spaced, regularly-shaped nanoparticles can find applications from sensoristics to photovoltaics, provided that their optical response is well understood.
Here, we present the spectroscopic ellipsometry (SE) data and analysis of a self-assembled system of core-shell nanoparticles, with gold as a core and the thermoresponsive polymer PNIPAM as a shell. The nanoparticles are arranged on an hexagonal lattice and deposited on glass. The interparticle distance is enough to avoid particle-particle interactions, thus the plasmonic properties of the lattice are dominated by the single-particle response. This Au/PNIPAM system is well suited to investigate the variation in the plasmonic response of Au nanoparticles when surrounded by a dielectric environment (PNIPAM), whose refractive index change with temperature.
For the data analysis and interpretation of the SE spectra, since commonly-used Effective Medium Approximations (EMA) don't provide enough accuracy, we applied a model that explicitly takes into account the key morphological parameters of our system (NPs size, shape, interparticle distance, distance from substrate) [2, 3, 4]. The main spectral feature of the SE data, caused by the plasmonic resonance, is correctly matched by the model. Thus, our approach provides detailed information about the optical properties of this system of nanoparticles, and more in general, it constitutes a flexible tool to investigate 2D arrays of plasmonic particles.

Keywords: core-shell nanoparticles; gold; PNIPAM

References

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