RECONFIGURABLE GOLD NANOPARTICLE SUPERLATTICELLS VIA RATIONAL DESIGN OF MESOGENIC LIGANDS

LEWANDOWSKI Wiktor, WALICKA Kinga, GÓRA Monika, KOŁPACZYŃSKA Milena, GÓRECKA Ewa, MIECZKOWSKI Józef

University of Warszawa, Warszawa, Poland, EU

Abstract
Bottom-up approach to nanoparticle (NP) synthesis proved to be a powerful tool for control of matter at the nanometer scale. It gives scientists and engineers access to NPs with predefined size, shape, constitution and consequently – properties. The current challenge is application of the ‘bottom-up’ strategy to realization of long-range ordered structures of NP – nanoparticle superlattices (SL).

One of the most promising approaches yielding well defined metal nanoparticle superlattices is covalent attachment of mesogenic ligands to NPs’ surface. In our previous work we have successfully applied this strategy and obtained smectic, modulated smectic and columnar phases made of gold nanoparticles via slight modifications in organic molecules architecture and primary ligand length.

Our latest results, which will be discussed, point to the distance between rigid mesogenic core and nanoparticle surface as a key factor for nanoparticle self-assembly type. Till now the impact of this parameter has been neglected. The outlined research has yielded in reconfigurable nanoparticle superlattices with temperature and, for the first time, shearing stress control over NP phase structure. What is unusual we could observe birefringence of thin hybrid nanoparticle samples. All the structures were thoroughly analyzed by SAXS, TEM, XPS, 1H NMR, POM studies.

Keywords: nanoparticles, self-assembly, liquid crystals, superlattice

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