

Correlations between Chemical Structure and Self-Assembly Behaviour in Mesogen Covered Nanoparticles

L.. Cseh¹, G. H. Mehl¹, X. Zeng², F. Liu², A. G. Fowler², G. Ungar², J. E. Macdonald³

(1) *Dept. of Chemistry, University of Hull, Hull, HU6 7RX, UK*, (2) *Dept. of Engineering Materials, University of Sheffield, Sheffield, UK*, (3) *School of Physics and Astronomy, Cardiff University, Cardiff, UK*

Considerable effort has gone recently into investigation of spherical colloidal particles dispersed in low molecular liquid crystals. While in most of these studies the particles are much larger than the LC molecules, here we use gold nanoparticles of typically 2 nm, i.e. comparable in size to the mesogen molecules attached to them laterally via alkylthiol spacers. In order to avoid surface overcrowding, only a fraction of the surface-bound alkylthiol carried the mesogen.^[1,2]

A number of mesogen-covered gold nanoparticle systems were examined, having different combinations of mesogen size, spacer length and mole fraction of unsubstituted alkylthiol. Most systems formed liquid crystals, as confirmed by polarized optical microscopy differential scanning calorimetry as well as X-ray diffraction experiments carried out on powder and oriented samples. Particularly high degree of uniaxial orientation was obtained in thin spin-cast films, on which grazing-incidence small-angle X-ray diffraction experiments were performed. From powder x-ray data electron density maps were reconstructed. Furthermore, TEM imaging and electron diffraction studies gave complementary information on the structure as well as on structural defects. These experiments have revealed complex 2-d and 3-d packing modes of nanoparticles, indicating intricate interactions between the packing of the metal particles and the surrounding mesogens.^[3]

References:

- [1] L. Cseh, G. H. Mehl, *J. Am. Chem. Soc.*, **2006**, *128*, 13376.
- [2] L. Cseh, G. H. Mehl, *J. Mater. Chem.* **2007**, *17*, 311.
- [3] X. Zeng, L. Cseh, A. Fowler, J. E. MacDonald, G. H. Mehl, G. Ungar, *Adv. Mater.* **2009**, *21*, 1746 .