Liquid Crystal-Capped Gold Nanoparticles by Ligand-Exchange Reactions

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The existing methods to fabricate Au NP arrays, such as lithography and templates directed, have found limited usage due to their low speed, high cost and difficulties to build a 2-D structure. The use of liquid crystal (LC) ligands and dispersing medium for the self-assembly of functionalized Au NP is therefore emerging as a "bottom-up" method for fabricating nanostructured materials [1]. The research undertaken here emphasizes a chemical approach to produce tailored capping layers that promote a stable and controllable dispersion of individual Au NPs in a host matrix. The preparation of Au NPs functionalized with mesogenic ligands in a 4-5 nm size range useful for optical applications is reported. Au NPs with 4'-(mercaptoalkoxy)-1,1'-biphenyl-4-carbonitrile liquid crystal (LC) ligands, HSnOCB (n = 8, 12, 16), only and mixed with hexanethiol ligands, HS(CH2)5CH3, of controllable surface ratios were prepared using a ligand-exchange reaction [2]. The stability of the NP solutions was found to increase with the length of the LC ligands and mixed monolayers. No liquid crystalline properties were detected by differential scanning calorimetry analysis. The ability to tune the ligand shell in a reproducible way will allow the preparation of stable NP dispersions in liquid crystal matrices for optical applications.

[1] T. Hegmann, H. Qi and V.M. Marx *J. Inorg. Organomet. Polym. & Mater.* **2007**, *17*, 483

[2] S. Rucareanu, V. J. Gandubert and R. B. Lennox *Chem. Mater.* **2006**, *18*, 4674