

Reconfigurable Liquid Crystals of Plasmonic Nanorods

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Elongated (high aspect ratio) rod-like particles in suspension can spontaneously organize into liquid crystal phases, due to excluded volume interactions.¹ While this phenomenon has been observed with various colloidal systems, including organic (e.g., viruses)² and inorganic (e.g., oxides) nanorods, plasmonic colloidal liquid crystals (CLCs) based on gold or silver nanorods remain largely unexplored. Here, we report on LC phases (nematic and smectic B, depending on concentration) found in aqueous suspensions of Au@Ag (core-shell) nanorods. We combine small-angle x-ray scattering (SAXS) and optical experiments to study the phase behavior of these charged plasmonic nanorods. LC suspensions align in both electric and magnetic fields, at field intensities comparable to those required by molecular LCs. Furthermore, the suspensions show a reversible transition from nematic to smectic B phases in response to thermal and photoinduced stimuli. Such original reconfigurability of these CLCs, imparting them with novel collective optical properties, makes them good candidates for designing photonic devices and responsive sensors.

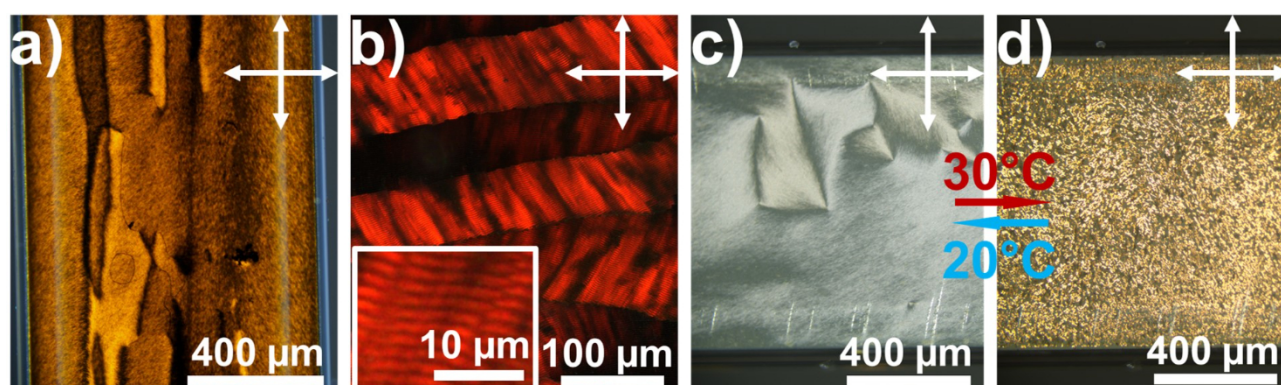


Fig. 1: a) and b) Polarized-light microscopy images of Nematic and Smectic B phases, respectively (the inset in b) is a magnified image showing the smectic layers); thermally-induced phase transition from c) Nematic to d) Smectic B phase.

References:

- [1] Onsager, L. *Ann. N. Y. Acad. Sci.* **1949**, 51 (4), 627–659.
- [2] Grelet, E. *Phys. Rev. X* **2014**, 4 (2), 021053.

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