Metal nanoparticles growth in nematic and smectic LC-mesophases

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Mesogenic nanosystems including silver and copper atoms and long-chain derivatives of alkyl- and alkoxycyanobiphenyls, cyanophenylpyridines and cyanophenylcyclohexanes have been obtained by vacuum co-condensation of reagent vapors on cooled surfaces of quartz, KBr, CaF_2 or polished copper under molecular beam conditions. Thermal treatment of co-condensate samples allowed the directed formation of metal nanoparticles from 2 up to 100 nm. Formation of silver nanoclusters was caused also by UV-irradiation of co-condensate films. It was shown that manner of temperature treatment and molecular self-organisation of different liquid crystalline phases controlled of the size and morphology of nanoparticles and their aggregates formed in the system. Transmission electron microscopy (TEM) and atomic force microscopy (AFM) data of the samples show the formation of highly ordered structures in nematic mesophases. Rising of metal concentration in the sample led to the performable growth of rod-like metal particles with anisometric ratio l/d>20 and intensive absorbance at higher wavelengths. Formation of flat 2D-aggregates has been found in layered smectic mesophases.

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