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## Optical SERS response of long distance organizations of metallic nanoparticles (Ag, Au and Cu)

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There is a considerable interest for producing and understanding the optical and spectroscopic properties of ordered nanocrystals (NCs) assemblies. We report unique properties of highly ordered 3D plasmonic superlattices made of NCs (Ag, Au or Cu) called supercrystals. For 3D assemblies, previous optical measurements were made on collections of supracrystal assemblies, which complicated the analysis, particularly since the substrate contribution and individual properties depend on the supercrystal height. Apart from usual systems used in surface enhanced Raman spectroscopy (SERS), the NCs we synthesized have a low diameter (between 4 and 10 nm) and a narrow size distribution (<10%). They are capped with alkyl chain to prevent coalescence and oxidation. This ligand can also be used as a vibrational probe. Because of their very narrow size distribution, these NCs self-organize in face-centered cubic (FCC) superlattices onto very large distances (several micrometres). These superlattices could thus be studied individually under an optical microscope. We describe the formation and characterization of NCs supercrystals, together with their optical and SERS properties. The enhancement factors have been calculated depending on the nature of the metallic NCs, the alkyl chain length and the NCs size.

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