Nanocrystallinity, Supracrystals: Unexpected behavior

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The nanocrystals with low size distribution self assemble in 3D superlattices called supracrystals.[1]The crystalline structure of nanocrystals called nanocrystallinity plays a key role on these self-assemblies.[2,3] Heterogeneous and homogeneous growth processes of supracrystals take place inducing marked changes in their physical properties.[4-8]

We describe some physical and chemical properties nanomaterials differing by the crystalline structure called nanocrystallinity: It is demonstrated that nanocrystallinity play a major role in the final structure when nanocrystals are subjected to oxidation processes (Kinkendall effect).[9]
Concerning the optical properties, some processes are markedly affected by the crystalline structure whereas others are negligeable.[10]
Note that a hierarchy in supracrystal growth processes, nanocrystalinity segregation[11], growth of quasi supracrystals[6,8] and supracrystals characterized by vicinal surfaces[12] are pointed out. Collective and intrinsic properties of either one or two components are demonstrated.

"Clustered" and "eggs" structures are hydrophobic supracrystals are dispersed in aqueous solution with a very high stability (almost two years). Solubilization of hydrophobic supracrystal in aqueous solution[9-11] is obtained with Co and Au supracrystals with appearance of tunable plasmonic metamaterials. With Au supracrystals, the optical properties revealed that the fingerprint of nanocrystal is preserved even for large crystalline aggregates demonstrating that the nanocrystal could be used as a probe for investigating the optical properties of such assemblies. Preliminary data obtained with such structures indicate that they are good candidate for ablation of cancer cells via photothermia processes. A rather large number of applications are expected with such water-soluble supracrystals.

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