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Metal-nanomaterials, nanocrystallinity, supracrystals

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We will describe some physical and chemical properties metal nanomaterials differing by the crystalline structure called nanocrystallinity: It will be demonstrated that nanocrystallinity play a major role in the final structure when nanocrystals are subjected to oxidation processes (Kinkendall effect). Concerning the optical properties, some processes are markedly affected by the crystalline structure whereas others are negligeable. Nanocrystals, characterized with low size distribution, self assembled in 3D superlattices to produce supracrystals. The final structure of the supracrystals depends on the experimental conditions. By mixing nanocrystals differing by their average diameter, binary supracrystals will be produced. Both one component and binary supracrystals are characterized by specific properties (optical, mechanical, magnetic) opening several research areas. Various water-soluble structures are produced from hydrophobic nanocrystals. With Au supracrystals, the optical properties revealed both photonic modes and localized surface plasmon resonance of the nanocrystals. Furthermore, the fingerprint of nanocrystal was preserved even for large crystalline aggregates demonstrating that the nanocrystal could be used as a probe for investigating the optical properties of such assemblies. These water-soluble supracrystals pave the way towards a large number of potential applications including solar energy and biomedicine.

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