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# Modulating the Physical Properties of nanocrystals and supracrystals through atoms and nanocrystals assembling: New Challenges.

M.P.Pileni

Laboratoire des Matériaux Mesoscopiques et Nanométriques (LM2N), Université Pierre et Marie Curie (UPMC), UMR CNRS 7070, bât F, BP 52, 4 place Jussieu, 75252 Paris Cedex 05, France.

Marie-paule.pileni@upmc.fr

## 1. Introduction

Here we will present physical properties related to the crystalline structure of nanoparticles called nanocrystallinity and to nanocrystals self ordered in 3D fcc superlattices called supracrystals.

## 2. Results and discussion

Here we will present physical properties related to the crystalline structure of nanoparticles called nanocrystallinity and to nanocrystals self ordered in 3D fcc superlattices called supracrystals.

Here, we will present the influence of the crystalline structure of nanoparticles called nanocrystallinity on different properties of nanocrystals with either single domain or polycrystalline structure [1]. The influence of nanocrystallinity on the localized surface plasmon resonance of individual nanocrystals dispersed in the same host medium is reported [2]. The localized surface plasmon resonance of a collection of Au nanocrystals dispersed in hexane changes with nanocrystallinity. The change in profile of the absorption band observed from polycrystalline and single domain nanocrystals is attributed to internal structural defects like twins, whose effect on the optical properties is not accounted for using current models [3] in the literature

By submitted nanocrystals to laser beam quadrupolar and breathing modes are observed. Here it is demonstrated for Au nanoparticles the quadrupolar modes are splitted due to elastic anisotropy lifting of degeneracy mode [4,5]. At the opposite, the breathing mode remains unchanged with Co and Au nanocrystals [1, 6].

Two collective vibrational properties are pointed out when the nanocrystals are self-ordered in 3D superlattices. Collective modes in which the nanocrystals vibrate in phase in fixed position in lattice without moving from one to the other are observed [7]. Furthermore, coherent propagating acoustic vibrational modes in which the nanocrystals vibrate like incompressible atoms are observed [8].

## 3. Conclusions

Major physical properties change with the ordering of both atoms in nanocrystals and nanocrystals in supracrystals

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