COLLOIDAL NANOPARTICLES WITH TAILORED COMPOSITIONS AND SURFACE FOR OPTICAL AND CATALYTIC APPLICATIONS

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Nanochemistry is at the cross-road of solid-state and molecular chemistry. Moreover, nanotechnology relies both on the core and surface properties of metal-containing nanoparticles. There is a need to design and study these objects with both aspects in mind, especially considering the high capability of matter to reorganize at this scale and the dynamics observed both for the inorganic part of the nanoparticles (the core, such as Cu(0),[1] FeP,[2] or Gd_2O_2S[3]) and for their shell of organic ligands (oleates, alkylphosphines, etc.). Such nano-crystals, with tailored structure and chemical composition, may be exploited for a number of applications once the links between structure and properties are mastered.

It is with this mindset that I will discuss the recent developments on several families of nanoparticles: metal and alloys,[4] metal phosphides[5] and metal oxysulfides.[6] I will propose principles for a rationale design of new synthetic routes, in which the role of all reactants and their stoichiometry is controlled. I will emphasize how surface reactivity influences the overall behavior of the nanoparticles. Finally, I will discuss how these nanoparticles may be employed for their optical properties (tunable band-gap)[6] and decorated with suitable organic ligands for boosting their catalytic properties.[7,8]

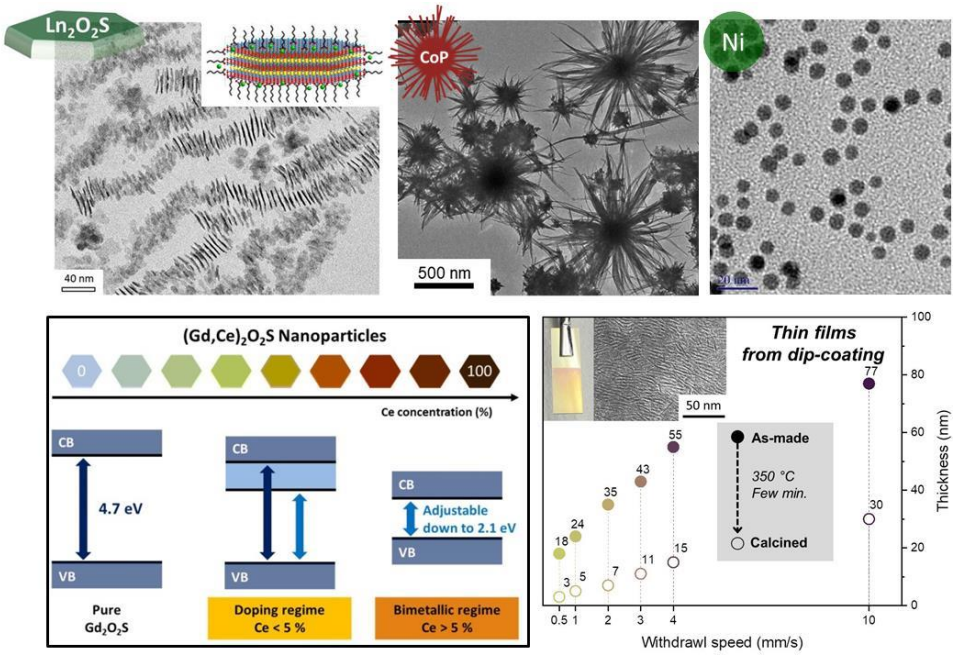

Figure 1: Top: Examples of nanoparticles: lanthanide oxysulfides, cobalt phosphide, nickel. **Bottom:** Tunable band gap of lanthanide oxysulfide nanoplates and preparation of thin films from colloidal suspensions

[1] X. Frogneux et al., *Catal. Sci. Technol.* **2018**, 8, 5073.
[2] F. D'Accriscio et al., *ChemNanoMat* **2020**, 8, 1208-1219
[3] C. Larquet et al., *Inorg. Chem.* **2017**, 56, 14227.
[4] S. Carenco, *Chem. Rec.* **2018**, 18, 1114-1124
[5] A.-M. Nguyen et al., *Chem. Mater.* **2019**, 31, 6124.
[6] C. Larquet et al., *Chem. Mater.* **2019**, 31, 5014-23.
[7] K. Azouzi et al., *ACS Catal* **2024**, 14, 3878-3888.
[8] A. Ropp, S. Carenco, *InorgChem* **2024**, 63, 17077-17086.