Nanoparticles with optimized properties : from chemical synthesis to assembly
A bottom-up approach for nanostructured materials

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Abstract

Synthesis of nanoparticles (NPs) exhibiting controlled size and shape has been a long-sought goal in developing various applications ranging from ultra-sensitive sensors to active catalysts.[1] Liquid phase synthesis based on inorganic precursors can lead to peculiar morphologies, far from the shapes thermodynamically favoured. We will present the examples of Pt and Au nanoparticles which can lead to 5 fold stars, porous dendrites or even ultrathin nanowires (Figure 1). [2,3]
A fine balance between attractive and repulsive forces lead to the self-assembly of Au nanowires (NWs) directly in solution to form unique expended hexagonal super-lattices, the parameters of which could be tune by modifying the surface chemistry of the objects. Remarkable conductivity properties, such as quantum phenomena at room temperature, were measured on such assemblies thanks to the unique 1D feature of the nanowires. [4] To go further, isolated NWs were trapped by nanoxerography to study the electronic properties of single NW [5], however Rayleigh instability is faced [6].

In a second part of the talk, bottom-up approach, consisting in the synthesis and assembly of particles, will be discussed as a very promising way to get new hard magnetic materials. We have recently demonstrated that rare-earth free permanent magnets could be elaborated using cobalt nanorods, assembled under external magnetic field. [7] Their performances, characterized by an energy product $(BH)_{max}$ exceeding 150 kJ.m^{-3}, already competes in the permanent magnets panorama.

References

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Figures

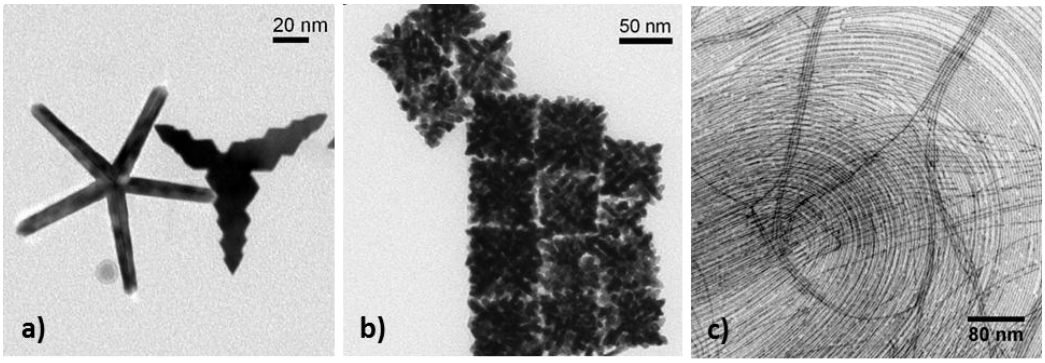

Figure 1 : Transmission electron microscopy images of Pt a) stars and b) dendrites and c) ultrathin Au nanowires.