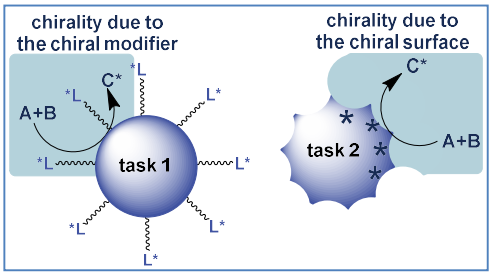
The Use of Organometallic Chemistry for the Synthesis of Chiral Nanocatalysts

Keywords : Organometallic chemistry, Nanoparticles synthesis, asymmetric catalysis

State of the art : To try to combine advantages of both the heterogeneous and the homogeneous catalysis, the so-call "homogeneous supported catalysis" strategy can be used: the soluble chiral catalyst is immobilized on a surface. The enantioselectivity thus arises from the action of the chiral catalyst and not from the surface. However, lack of both reactivity and selectivity were frequently reported compared to the native homogeneous catalyst, due to the steric hindrance and the problem of mass transport in the porous supports often preferred due to their high surface area.[1] More recently, nanoparticles (NPs) have proved to be a powerful alternative to classical supports as it allows a huge increase in the accessibility of the active site, maintaining the reactivity and selectivity observed in homogeneous catalysis. This is partially explained by the presence of corners and edges that constitute sites of weak coordination increasing the reactivity of the surface atoms. Major drawbacks of NPs would be the harsh conditions required for their synthesis as well as their purification. Thus, by developing milder NP-synthesis conditions, huge improvements could be made in NP-supported catalysis.

Project: **The aim of this project is to elaborate new chiral nanocatalysts for asymmetric catalysis, based on a mild and tunable nanoparticle synthesis** on 3d metals (Ni, Co, and Co-Ni). To reach that goal we will study two approaches: the first one deals with the anchoring of several families of chiral ligand on the surface of the NPs. We will run a high throughput screening of the chiral ligand based on our new ultra-fast (10 minutes) synthesis of hcp-cobalt NCs at room temperature.[2] The second approach is based on the elaboration of new intrinsically chiral NPs (Ni, Co, and Co-Ni) through breaking symmetry. Strategies based on the nanocristallinity, chiral templating or shape anisotropy will be considered to decrease progressively the symmetry and induce a NP chiral morphology through adsorption of chiral ligand during or after the synthesis. All these new chiral objects will be tested in asymmetric reduction of ketones or imines.



Candidate Profile: The candidate must have solid theoretical and practical knowledge in organometallic chemistry and coordination chemistry. Experience asymmetric catalysis and /or nanomaterial would be a plus. The candidate must have an excellent ability to work in a team and take initiatives. French and/or English speaking and writing is essential. **The fellowship is already accorded from Sorbonne Université (Initiative de Sciences et Ingénierie Moléculaires) and the candidate should be confirmed before May 2021**.

***Contact*:** Please send your cv, motivation letter and recommendation letter to Dr Marc Petit and Dr Caroline Salzemann.

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