Thursday October 12th _ 11:00 a.m.

Campus Jussieu, room 317, 3rd floor [43-44]

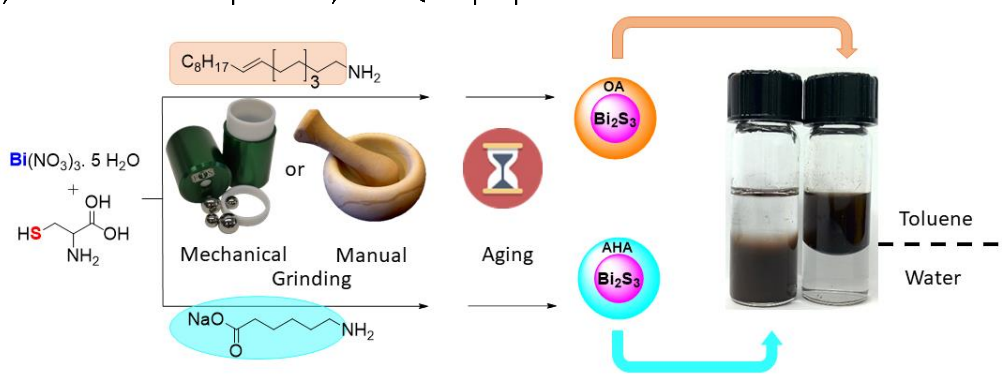
Pr. Audrey Moores

Audrey Moores, Centre for Green Chemistry and Catalysis, McGill University, 801 Sherbrooke St. West, Montreal, QC, Canada, H3A-0B8

Solvent-free Synthesis of Metal and Sulfide Nanoparticles and mechanochemistry

Nanomaterials are intensely researched for their powerful properties applicable in the broad fields of medicine, electronics, optics and catalysis. Because metal NPs are kinetically stabilized materials, their synthesis often relies on the use of excess solvents, additives and strong reducing agents, which limits their easy scale-up. To address this shortcoming, we developed a novel synthetic method for the scalable production of metal and metal sulfide NPs under solvent-free, mechanochemical conditions. The synthesis of Au NPs provided access to monodisperse and ultra-small NPs in the size range of 1–4 nm, without external reducing agents or bulk solvents.[1] Using lignin as a biomass-based reducer, we could access embedded NPs of Au, Ru, Pd and Re.[2] With Ag, this method gave access to antibacterial filters in a simplified fashion.[3]

We also explored the synthesis of metal sulfide with similar Bi_2S_3 nanoparticles were easily synthesized by mechanochemical activation from molecular precursors and cysteine as a sulfur source, followed by aging to afford X-ray active materials. These materials are exciting candidates for cancer detection.[4] A similar approach was used to access easily ZnS, CdS and PbS nanoparticles, with Qdot properties.



Finally, we are using mechanochemistry as a tool to achieve polymer functionalization and organic transformation. We recently reported a method to derivatize poly(ethylene glycol) (PEG) rapidly and without solvent, with tosyl, bromide, thiol, carboxylic acid or amine functionalities in good to quantitative yields and with no polymer chain oligomerization.[5] We also developed a solid-phase method for the transfer hydrogenation of carbonyls, relying on polymethylhydrosiloxane as waste-derived hydrogen source.[6]

1. M. J. Rak, N. K. Saadé, T. Friščić and A. Moores, *Green Chem.*, 2014, **16**, 86-89.
2. M. J. Rak, T. Friščić and A. H. Moores, *Faraday Discuss.*, 2014, **170**, 155-167.
3. M. J. Rak, T. Friščić and A. Moores, *RSC Adv.*, 2016, **6**, 58365-58370.
4. M. Y. Malca, H. Bao, T. Bastaille, N. K. Saadé, J. M. Kinsella, T. Friščić and A. Moores, *Chem. Mater.*, 2017, **29**, 7766–7773.
5. M. Y. Malca, P.-O. Ferko, T. Friščić and A. Moores, *Beilstein J. Org. Chem.*, 2017, **13**, 1963-1968.
6. A. Y. Li, A. Segalla, C. J. Li and A. Moores, *Submitted*, 2017.