SYNTHESIS OF A FAMILY OF STAR-SHAPED MOLECULAR GEARS

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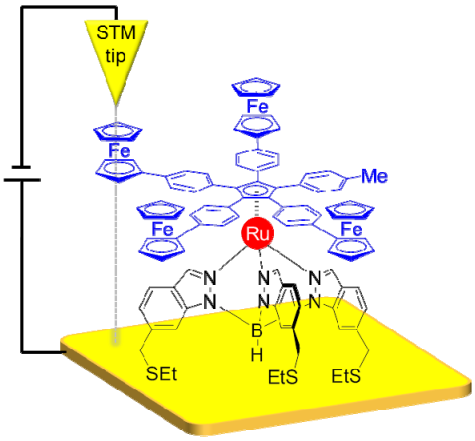
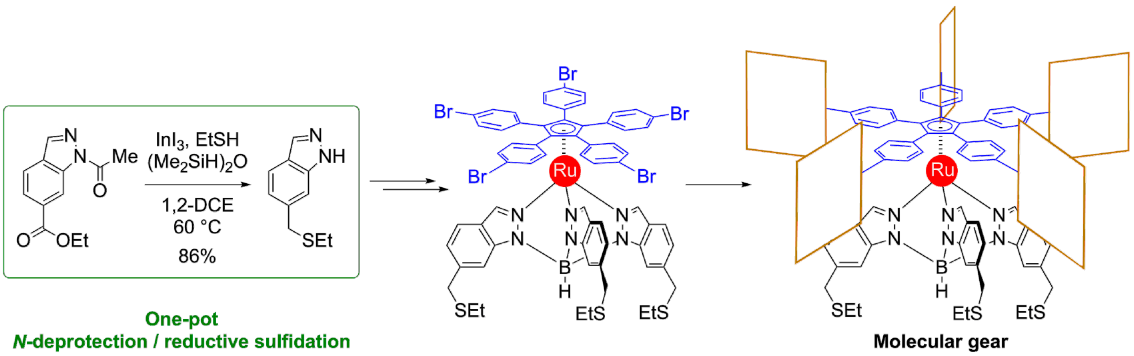
In a context of ultimate miniaturization, obtaining nanometer-sized devices and mastering their controlled motion triggered by an external stimulus is highly desirable.

Following a bottom-up approach, our group has designed and synthesized electron-fueled molecular motors, to be studied on surface at the single molecule scale by Scanning Tunneling Microscopy (STM) [1]. One of these ruthenium-based organometallic motors, featuring a dissymmetric rotating subunit, has been shown to undergo unidirectional rotary motion upon excitation, with a direction of rotation governed by the location of the STM tip [2].



Our next aim is to investigate the mechanical transfer of rotary motion between neighbouring molecules, so as to propagate the unidirectional motion of the motor through a train of molecular gears. We have thus designed ruthenium-based complexes bearing penta(aryl)cyclopentadienyl ligands geometrically analogous to cogwheels, with aryl, carbazole, BODIPY or porphyrin fragments acting as teeth.

The multi-step synthesis of this family of molecular gears will be presented, with a focus on the methodological work allowing step economy and high efficiency in the synthesis of the thioether-functionalized hydrotris(indazolyl)borate ligand [3].



[1] Kammerer, C.; Rapenne, G. *Eur. J. Inorg. Chem.* **2016**, 2214.

[2] Rapenne, G.; Joachim, C.; Hla, S.-W. *et al. Nature Nanotechnol.* **2013**, *8*, 46.

[3] Erbland, G.; Gisbert, Y.; Rapenne, G.; Kammerer, C. *Eur. J. Org. Chem.* **2018**, 4731.