Mechanically interlocked molecules: design, synthesis, and applications

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Mechanically interlocked molecules (MIMs) such as rotaxanes and catenanes (Figure 1)[i] have been transformed from mere synthetic curiosities to functional materials with practical applications in a range of fields: artificial molecular machines, smart materials, catalysis, molecular recognition, and sensing among others[ii] thanks to the different synthetic methodologies that had been developed over the years.[iii]

In the first part of the talk, I will discuss the different chiral auxiliary methodologies that have been developed for the active-template stereoselective syntheses of mechanically chiral rotaxanes and catenanes.[iv] In addition, I will present how a single, simple amino-acid-derived macrocycle bearing a chiral auxiliary mediates the formation of both catenanes and rotaxanes in excellent stereoselectivity.[v]

In the second part of the talk, I will discuss a new general approach to stimuli-responsive cleavable macrocycles (e.g. chemical, photochemical, enzymatic) based on a bipyridine motif and the application of the latter in the synthesis of stimuli-responsive rotaxanes and catenanes.[vi]. In addition, I will show that this platform can be applied to other macrocycles for rotaxane synthesis (e.g. crown ether) demonstrating the versatility of this chemistry.

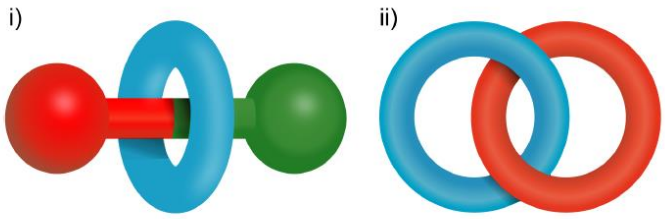

Figure 1. Schematic representation of a [2]rotaxane (i) and a [2]catenane (ii).

References

[i]. *Angew. Chem. Int. Ed*. **2017**, *56*, *11094-11125.*
[ii] *Chem. Soc. Rev*. **2019**, *48*, 5016-5032.
[iii] *Chem. Soc. Rev*. **2017**, *46, 2577-2591. Chem*, **2023**, **9**, 2110-2127.
[iv] *Chem*, **2020**, **6**, 1914–1932. *Nature Chem*. **2022**, 14, 179-187.
[v] *Chem*, **2023**, **9**, 1195-1207.
[vi] Saady et.al 2023, under review.