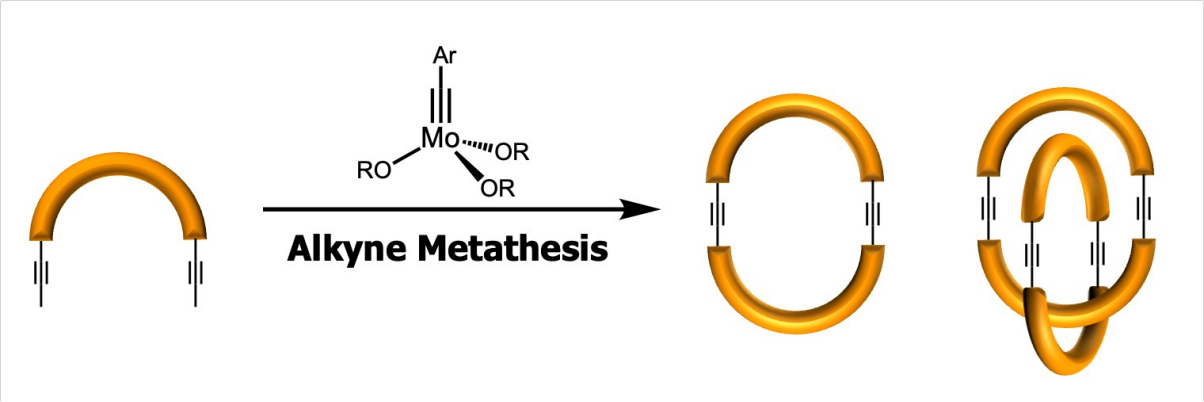
Synthesis of Macrocycles and Mechanically Interlocked Molecules via Alkyne Metathesis

Semin Lee
Department of Chemistry, Louisiana State University
Baton Rouge, Louisiana



Mechanically interlocked molecules (MIMs) with rigid components (axle, strut, thread, etc.) have advantages over those with flexible components. For instance, rotaxanes with rigid threads prevent unintended side-reactions such as harpooning[1] and backfolding.[2] Rigid struts are required to maintain porosity and switching in metal organic rotaxane frameworks.[3] In addition, there have been studies where switching or shuttling kinetics were not affected by the axle lengths when they are rigid.[4]

Arylene-ethynylene groups are commonly used building blocks for constructing rigid components in MIMs. Alkyne metathesis is a powerful synthetic method to prepare various arylene-ethynylene based molecules through dynamic covalent chemistry. We envision that alkyne metathesis can provide an efficient and high-yielding pathway toward MIMs with rigid components.

Here, we will discuss the use of alkyne metathesis to prepare macrocycle and carbon nanohoops.[5,6] Further, we will discuss the potential use of alkyne metathesis to prepare mechanically interlocked molecules in an efficient manner.

References

1. Baggerman, J.; Haraszkiewicz, N.; Wiering, P. G.; Fioravanti, G.; Marcaccio, M.; Paolucci, F.; Kay, E. R.; Leigh, D. A.; Brouwer, A. M. *Chem. Eur. J*. **2013**, *19*, 5566-5577.
2. Jeppesen, J. O.; Vignon, S. A.; Stoddart, J. F. *Chem. Eur. J.* **2003**, *9,* 4611-4625.
3. Wilson, B. H.; Loeb, S. J. *Chem* **2020**, *6*, 1604-1612.
4. Young, P. G.; Hirose, K.; Tobe, Y. *J. Am. Chem. Soc.* **2014**, *136*, 7899-7906.
5. Zhou, X.; Thompson, R. R.; Fronczek, F. R.; Lee, S. *Org. Lett.* **2019**, *21*, 4680-4683.
6. Zhou, X.; Kwon, H.; Thompson, R. R.; Herman, R. J.; Fronczek, F. R.; Bruns, C. J.; Lee, S. *Chem. Commun.* **2021**, *57*, 10887-10890.