2013-08


Pantelopulos, George

https://hdl.handle.net/2144/12984

Boston University
Carbon Nanotubes (CNTs) are nano-scale tubes composed of fused benzene rings. The electronic and optical properties of CNTs are determined by chirality and diameter. CNTs are of great interest in developing a multitude of revolutionary technologies due to these properties.

The formation of CNTs may be conceived as the rolling up of a sheet of Cycloparaphenylene upon a given axis to form CNTs of a particular chirality. The diameter of the graphene sheet affects the diameter of the CNT.

These syn three ringed pieces are coupled together via an orthogonal Suzuki-Miyaura cross-coupling. These yield a six or nine ringed terminal dichloride depending on the pieces used. Chlorine does not typically participate in Suzuki coupling.

These six and nine ringed terminal dichlorides may undergo coupling into three unique macrocycles each. This is achieved via reactivity granted to the terminal chlorides by Buchwald's S-Phos ligand to couple with boronic acid esters such as Bpin. These macrocycles are aromatized with sodium naphthalenide to form the CPPs.

This synthesis may be reapplied with thiophene to create more electron-rich nanohoops and potentially electron-rich nanotubes which may serve an important role in new solar cell technologies. We have begun pursuing the installation of a single thiophene into a CPP structure to explore this. The single thiophene is to be on a ketone used to build one of the three ring building blocks.

As this synthesis would hopefully draw heavily upon skills and methods previously developed in the lab it may be easy to execute. An approach which slowly adds more and more thiophenes to nanohoops will be utilized to minimize the number of possible problems with the synthesis encountered along the way.

Acknowledgements
I would like to thank the National Science Foundation for funding my REU program studies, the REU programmers for all of their work in making this possible, Boston University for hosting me, Ramesh Jasti for having me in the group, Thomas Sisto for mentoring me through the summer, and the rest of the Jasti group members for everything I have learned from them throughout this experience.

References
1) Sisto, T. J.; Jasti, R. Synlett 2012, 23, 483
2) Sisto, T. J.; Golder, M. R.; Hirst, E. S.; Jasti, R. JACS 2011, 133 (40), 15800