Synthesis of a new fullerene/transition metal bridge for charge transfer applications

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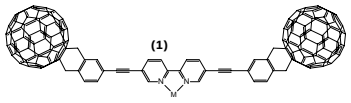
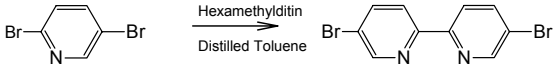


Objective: The primary objective of our research is to create systems that efficiently move charge when excited by light. Such systems have possible applications in solar cell development, molecular device and computer applications. An example of a system in the making is a fullerene-transition metal system in which, a fullerene, C_{60}, is attached to a transition metal through a bipyridine ligand. Fullerenes have large absorption cross areas and readily accept multiple electrons, which serve as advantageous properties in photo-induced charge transfer applications. A rigid conjugated link between the fullerene and the metal has been designed to enhance the ability of charge to flow from the metal to the fullerene and vice-versa.

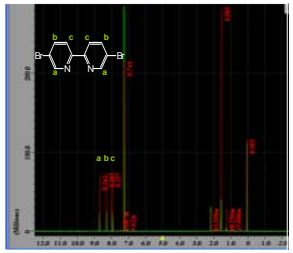
Synthesis of (1)

Reaction Family A

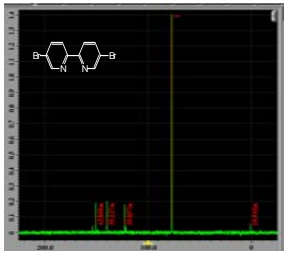
Step 1:



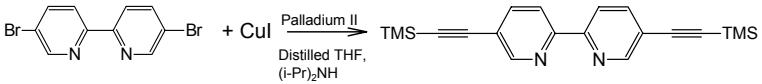
^{1}H NMR of 5,5'-Dibromo-2,2'-Bipyridine



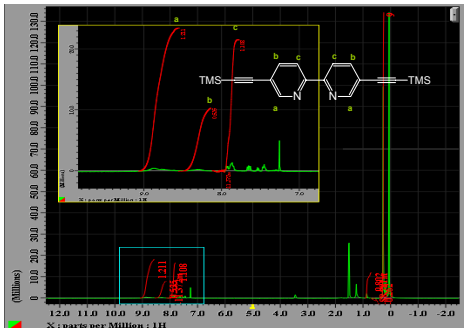
^{13}C NMR of 5,5'-Dibromo-2,2'-Bipyridine



Step 2:

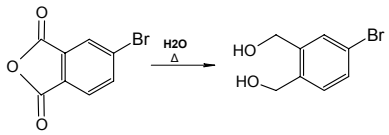


^{1}H NMR of 5,5'-Trimethylsilylethynyl-2,2'-bipyridine

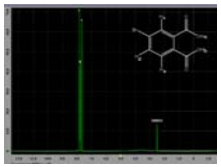


Reaction Family B

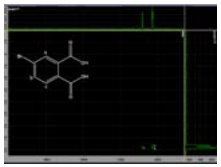
Step 1:



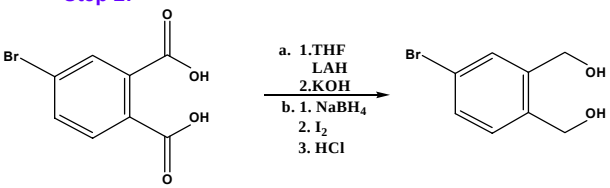
^{1}H NMR of 4-Bromophthalic Acid



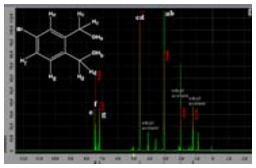
^{1}H/^{13}C Correlation of 4- Bromophtalic Acid



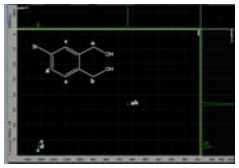
Step 2:



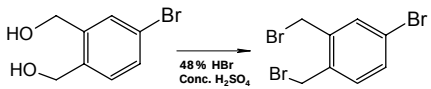
^{1}H NMR of 4-Bromo-o-xylene



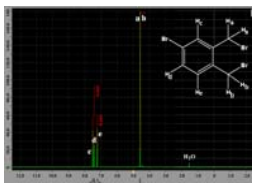
^{1}H/^{13}C Correlation of 4-Bromo-o-xylene



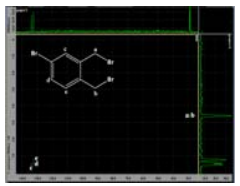
Step 3:



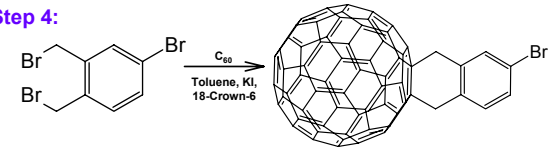
^{1}H NMR of 4,α,α-Tribromo-o-xylene



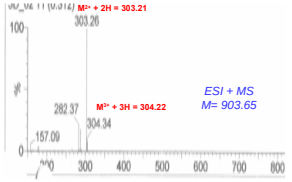
^{1}H/^{13}C Correlation of 4,α,α-Tribromo-o-xylene



Step 4:



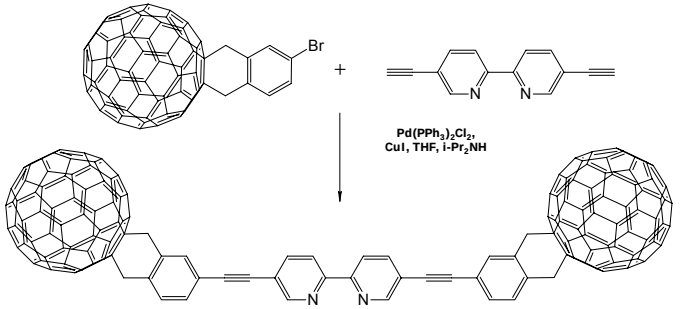
Mass Spectra



1H NMR Spectra Revealed Expected Peaks, but Low Solubility Impedes a Good Spectra

Next Steps:

The next steps involve merging Reaction Families A and B together and conjugating the synthesized complex with a transition metal. The resulting complex will undergo a complete photophysical evaluation.



References

1. Anderson, P.S.; Christy, M.E.; Colton, C. Dylion; Halczrnko, W.; Ponticello, G.S.; Shepard, K.L. *J. Org. Chem.* **1979**, 44, 1519-1533.
2. Belic, P.; Gügel, A.; Kraus, M.W., Walter; M.; Müllen, K. *J. Org. Chem.* **1995**, 60, 3307-3310.
3. Bruce, J.; Chambron, J.P.; Kolle, P.; Sauvage, J.P. *J. Chem. Soc., Perkin Trans 1.* **2002**, 1226-1231.
4. Ley, K.D.; Schanze, K.S. *Coord. Chem. Rev.* **1998**, 171, 287-307.
5. Simek, J.W.; Tuck, T.; Bush, K.C. *J. of Chem Education.* **1997**, 74, 107-108.
6. Taki, M.; Sugita, S.; Nakamura, Y.; Kasashima, E.; Yashima, E.; Okamoto, Y.; Nishimura, J. *J. Am. Chem. Soc.* **1997**, 119, 926-932.
7. Walters, K.A. In *Comprehensive Coordination Chemistry II: From Biology to Nanotechnology*; Lever, A.B.P., Ed.; Elsevier; **2003**, Vol. 1.
8. Walters, K.A.; Ley, K.D.; Cavalaheiro, C.S.P.; Miller, S.E.; Gosztola, D.; Wasielewski, M.R.; Bussandri, A.P.; van Willigen, H.; Schanze, K.S. *J. Am. Chem. Soc.* **2001**, 123, 8329-8342.

Acknowledgements

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