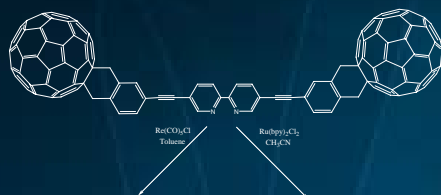


Synthesis of a novel fullerene-bipyridine ligand for photoelectric applications

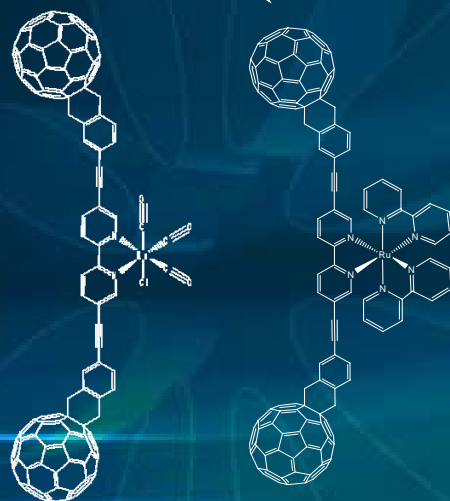
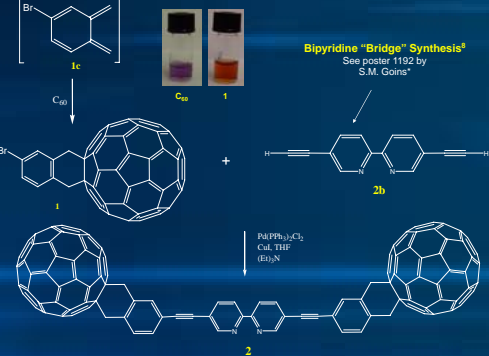
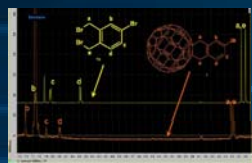
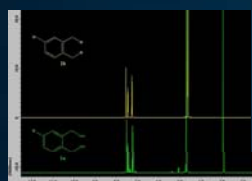
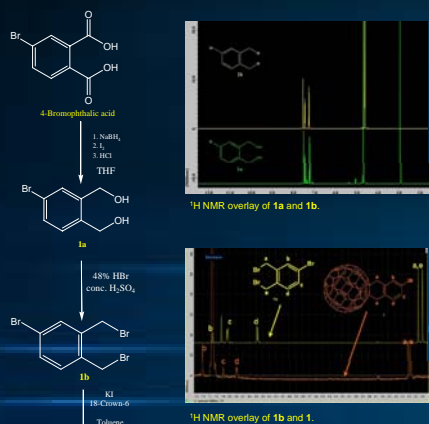


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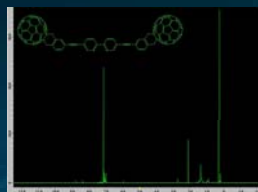
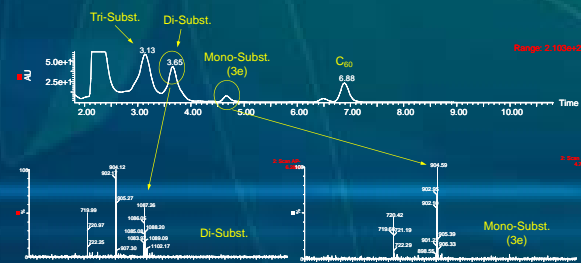
Objective: The primary objective of our research is to synthesize supramolecular systems that move electrons efficiently when excited by a photon of light. One such system is in development: two fullerene "handles" connected through a conjugated bipyridine "bridge." Fullerenes (C₆₀) have large cross areas which enable them to absorb photons of light. Fullerenes also have extensive conjugated pi systems, allowing them to be "dumping grounds" for excess electrons. Our supramolecular system (molecule **2**), when coordinated with a transition metal, has great potential for photon induced charge transfer applications. The fullerenes accept a photon of light, exciting electrons to a higher energy state, and transfer those electrons to the coordinated metal which conducts the charge out of the system, or vice-versa. Practical uses for our system include solar cells, molecular devices, computer applications, or other areas where molecules need to interact with light.



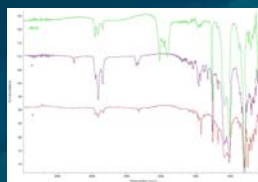
Fullerene "Handle" Synthesis



HPLC/MS (IPA/Hexanes) of 1



¹H NMR of ligand 2.

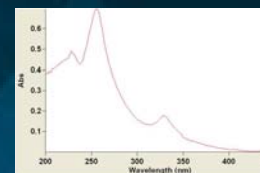


ATR-FTIR overlay of "handle 1, ligand 2, and the 2M-Re complex.

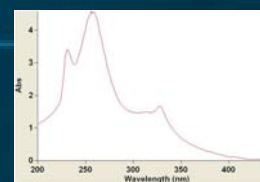
As shown in the IR overlay above, the telltale stretches associated with the fullerene are consistent throughout supporting successful syntheses. Also, the carbonyl stretches from the rhenium complex are quite evident, further indicating success.

The Ultraviolet-visible spectra at right show the expected emission(s) for fullerene.¹⁰ However, the rhenium complex shows additional emission which suggests charge transfer between the fullerene and the metal.⁹ This is very exciting as the main goal of this project is to construct a system that allows for such interaction between fullerenes and transition metals.

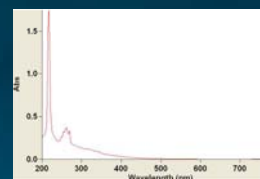
UV-Vis Absorption Spectra



1 in MeCl₂

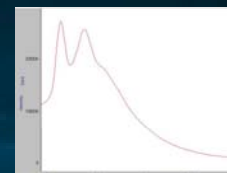


2 in MeCl₂

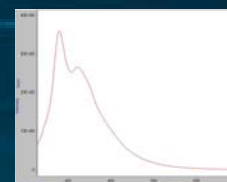


2M-Re in THF

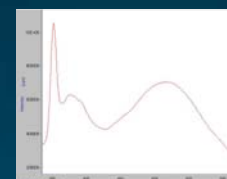
UV-Vis Emission Spectra



1 in MeCl₂

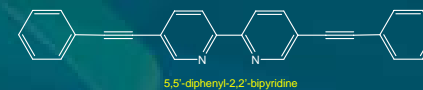


2 in MeCl₂



2M-Re in THF

Next Steps: The next phases of the project are to characterize the metal complexes of **2** and investigate the photochemical properties of these complexes. Studies to be performed include transient absorption (Nd-YAG laser) and Stark spectroscopy. Also, a spectroscopic comparison of ligand **2** and 5,5'-diphenyl-2,2'-bipyridine, and its metal complexes, will be conducted. These next steps are fast approaching and will be achieved within the next few months, making this an exciting time to be involved with the Walters Research Group.



Acknowledgements

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