Synthesis of Acetylene-Perfluorinatedpyridine Monomer for Click Mediated Linear Polymerization

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Polymerization is the process by which building block molecules (monomers) are joined together to form a large chain or network. The chemical properties of a polymer are determined by the specific properties of the monomers that make it and the type of linking used to attach the monomers. The purpose of my project was to synthesize a monomer with physical strength, chemical and temperature tolerance, ability to interact with its environment, and terminal functionality for ease of polymerization. One-pot coupling reactions followed by liquid-liquid extraction, filtration, and chromatography were employed for synthesis of the molecule. Analytical Sample Analysis Probe with a tandem Mass Spectrometer, Nuclear Magnetic Resonance, and Thin-Layer Chromatography were used to monitor for desired structural changes within the monomer. The yield of each reaction step makes the synthesis process applicable industrially. Copper(I) Catalyzed Azide-Alkyne Cycloaddition "Click Chemistry", a reaction defined by its high efficiency at combining nearly any two molecules containing an azide and alkyne fragments, was tested as a linear polymerization strategy. The polymer has potential for interaction with metals. The lone pair of electrons on the nitrogen centrally located in the monomer will allow the formation of coordinate covalent bonds with metal ions. These types of complexes are known as metal-organic frameworks or porous coordination polymers. Currently, metal-organic frameworks are being used for water and air purification, drug delivery, and as separation membranes. Future direction will include investigation into polymerization strategies for the creation of applicable metal-organic frameworks.