Oral Presentation

Solar Thermal Fuels - Advancement of Renewable Energy Via Organic Chemistry

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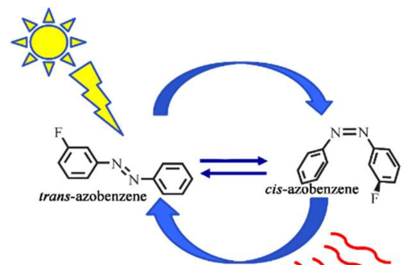
Abstract



Schematic of Molecular Solar Fuel

Solar thermal fuels are compounds that store solar photon energy by photoisomerization to a higher energy, metastable state. Azobenzene is one potential photoswitch for solar thermal fuels and has advantages of photostability and facile synthesis. Subsequent release of heat can occur spontaneously or by visible irradiation. The *cis-trans* isomerization is the energy storage process for azobenzene. Substituents can control irradiation wavelength, lifetime of metastable stable state, and isomerization enthalpy (ΔH=150-300 J/g). If one envisions a solar energy storage system that utilizes flow between the solar collection and heat exchanger, then azobenzenes with *cis* and *trans* melting points above the operating temperature would enable flow technology. Our strategy for synthesizing and characterizing energy storage azobenzenes is guided by a comprehensive literature survey of azobenzene melting points. Generally, *cis* melts lower than *trans* due to more disordered structure. Because the azo bond is the locus of energy storage, adding substituents will reduce the gravimetric energy density. Therefore, our initial studies focus on mono-substituted azobenzenes. For the same substituent, the melting points increase in the order *para* > *meta* > *ortho*. The most promising substituents are methyl, ethyl, methoxy, trifluoromethyl, and fluoro. These functional groups are afforded from a facile synthetic schema with efficient and fast reactions. Our research is also focused on the application of azobenzene to an aqueous zinc battery. The future of renewable energy is benefited by the application of organic chemistry for facile, abundant, and highly versatile synthetic methodologies.

Biography of Presenter

Scott Barrett is a Graduate Research Assistant at Texas State University. He received his B.S. of Chemistry from Texas State University in 2017 and M.S. of Chemistry in 2022. He is currently in the MSEC (Material Science, Engineering, and Commercialization) PhD program at Texas State University. He practices synthetic organic chemistry over photochemical species such as Azobenzene and Spiropyran. Currently his research focuses on solar fuel cell functionalization with a specialty in azobenzene synthesis. In addition, he is also researching the application of azobenzene to organic batteries. He is interested in researching other organic chemicals for material science applications into renewable energies, such as solar panels.