Organic/Polymeric Materials – Design Strategy for New Optoelectronic Materials and Post-Functionalization of Waste Materials

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Conjugated polymers (CPs) play a leading role in the field of organic semiconducting materials. These polymers have great electronic, thermal, and optical properties. Besides, they have better solubility, low-temperature processability, and mechanical properties when compared to conventional semiconductors. These characteristics are very attractive for applications such as Organic Light-Emitting Diodes (OLEDs), Organic Field Effect Transistors (OFETs), photovoltaic devices, power storing devices and sensors. In this presentation, we will discuss our design strategy, synthesis, and characterization of two kinds of CPs; polyphenoxazine, which is a polyaniline mimic, and a new n-type DPP polymer developed from a new DPP scaffold.

Grand challenges continues for the efficient synthesis of known compounds and the development of new and interesting compounds using C-H functionalization reactions; specifically when the compounds to be synthesized are material focused. However, due to the highly active research in this area, C-H functionalization has been demonstrated to be a very useful technique for the synthesis of materials for organic devices such as OFETs, OLEDs, and OPVs. Still, very few studies have been done to investigate the use of C-H activation reaction to prepare fluorescent dyes. Consequently, our group has been investigating the use of C-H activation reaction to prepare NIR fluorescent dyes for application as biosensors, and in deep tissue imaging. In this presentation, we describe our design rationale for a series of new water-soluble NIR dye that is readily accessible by the C-H activation reaction. These dyes have absorption and emission wavelengths between 700 nm – 1100 nm, are photostable; however, they have poor quantum efficiency.

Additionally, C-H functionalization has been demonstrated in the post-modification of commodity products to change their properties. Recently, our group has been investigating the use of C-H activation chemistry to post functionalized high-performance materials to discover new high-performance materials. C-H borylation is used to functionalize high-performance lubricants to convert them to high-performance sealants. We will discuss the new properties of the materials in this presentation.