Pyrazine as Noncovalent Conformational Locks in Semiconducting Polymers for Enhanced Charge Transport and Stability in Thin Film Transistors

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Abstract Title:

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Abstract:

π-Conjugated semiconducting polymers are the topic of extensive research for various applications to next generation organic electronics. Despite their good charge transport (conductivity), current polymers lack an effective shape and structure conformability. This is an important drawback as the production of new technology now requires mechanical robustness and flexibility. Therefore, new design strategies towards new conjugated polymers with better charge transport and mechanical properties would be highly desirable and would provide new opportunities for the fabrication of low-cost and large area electronic devices.

Our group recently developed a new family of conjugated polymers based on diketopyrrolopyrrole (DPP), an electroactive pigment. By chemical synthesis, the addition of a thiophene-flanked pyrazine moiety was performed. The DPP units, in conjunction with the pyrazine-containing moieties, facilitated a conformational locking effect through non-covalent nitrogen-sulfur interactions. Interestingly, this conformational locking effect, once enabled into the polymers, improved the electronic properties and charge transport, as they increase molecular planarity. The new polymer's charge mobility was measured through the fabrication of thin film transistors and exhibited an improvement in comparison to the thiophene analogue. Various techniques were used for the characterization of the new materials, such as atomic force microscopy (AFM) and X-ray diffraction. Our results indicated that pyrazine moieties led to an optimal morphology for devices, which was smooth in the solid-state with large crystalline domains.

This presentation will highlight the key points of a novel polymer design and discuss the application of the new materials towards the fabrication of low-cost conductive polymers.