**Processable and Electrochemically Stable Polyaniline Derivatives: Synthesis, Characterization, and Applications**

Amongst all intrinsic conducting polymers, polyaniline (PANI) has attracted significant attention due to its outstanding air and moisture stability, simple preparation technique, and high electrical conductivity. Nevertheless, as a conducting material, polyaniline still shares two major drawbacks: poor solubility and inferior electrochemical performance. Herein, we designed and synthesized a wide range of poly(heterocyclic diphenylamine) based on the phenoxazine, phenothiazine, carbazole, phenazaborine, and phenazasiline cores to address the drawbacks of PANI. These cores maintain the PANI backbone but are designed to improve the electrochemical stability and add solubilizing groups to improve their processability. All the polymers were shown to be soluble with medium sized branched alkyl chains. The electrochemical characterization of the polymer containing the electron-rich heteroatoms such as phenoxazine and phenothiazine and electron rich core such as carbazole have shown remarkable electrochemical stability in CV. Furthermore, the electron paramagnetic resonance (EPR) analysis with several dopants reveals paramagnetic properties of the polaronic state of the polymers. The morphologies of polymer films were studied using atomic force microscopy (AFM), scanning electron microscopy (SEM), and transmission electron microscopy (TEM), which shows a variety of different morphology of the material surface based on dopants and film-forming procedures. Finally, the performances of these polymers in semiconductors, supercapacitors, and transistors were evaluated.

