

Abstract:

The growing demand for new materials for electronics that could offer novel functionalities for everyday use and for special applications in healthcare and industry, together with concerns about energy consumption, have stimulated an increasing research on electrical properties of conjugated macromolecules. The superiority of these macromolecules arises from their inherent properties based on alternating single and double bonds. In this thesis, charge transport in conducting polymers, namely polypyrrole, poly(*p*-phenylenediamine) and polyaniline, and their composites was investigated with respect to various morphology controlled by oxidant-to-monomer ratio, composite composition and other modifications of their synthesis. Based on a combination of various experimental techniques, like impedance spectroscopy, electron microscopy, electrochemical and optical measurements, the relation between the morphology and charge carrier transport was elucidated. The variable range hopping was found to be a dominant mechanism in the studied polymers. Additionally, metallo-supramolecular polymers have been prepared that offer well-organized structures by complexation of conjugated segments with metal ions. The spectro-electrochemical studies revealed electrochromic phenomena in these polymers. By optimization of the oligomer conjugated sequence, electrochromic properties were tuned and a prototype solid-state electrochromic device was fabricated, showing an efficient and fast electrochromic switching.