Molecular Packing of Charged Conjugated Polymer Studied by Atomic Force Microscopy

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Abstract:

Conjugated polymers are polyunsaturated compounds which consist of at least one backbone chain of alternating double and single bonds. These organic semiconductors are used in various applications such as light-emitting diodes, photovoltaic devices, field-effect transistors, and flexible displays. Emission color (band gap) can be tuned by molecular structures. The conformation of polymer chains and the subsequent packing of these chains in film influence the electronic properties. By introducing charged side-groups, the polymers are soluble in water or methanol, and therefore, can find application in biosensors. Also, the polymer conformation can be controlled by changing solution pH or adding salt.

We studied two charged conjugated polymers (conjugated polyelectrolytes), trimethylammonium polyfluorenes, that contain either an electron transporting unit (ETP) or hole transporting unit (HTP) under different processing conditions. The HTP contains a 1,4-phenylene unit whereas the ETP has a 2,1,3-benzothiadiazole unit.

Specifically, we examined changing the polymer concentration, solvent (water versus methanol), and salt (type of salt, $NaBIm_4$ or NaBr, and salt concentration). Change in polymer conformation in solution and molecular packing in film were monitored by spectroscopy and atomic force microscopy.