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Electrical characteristics of π -Conjugated Polymer Single Nanowire using Atomic Force Microscopy

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π -conjugated polymer nanowire such as polypyrrole (PPy) and polythiophene (PTh) were synthesized through electrochemical polymerization method by using anodic aluminum oxide (Al₂O₃) nanoporous template. To confirm the formation of π -conjugated polymer nanowires, we performed scanning electron microscope (SEM) and transmission electron microscopy (TEM) experiments. Structural and optical properties of π -conjugated polymer nanowires were examined by using Ultraviolet and visible (UV/Vis) absorbance spectra and Fourier transform infrared (FT-IR) spectra experiments. We controlled the doping level, the π - π^* transition peak, and bipolaron peaks. The electrical characteristics of π -conjugated polymer single nanowire by using atomic force microscopy (AFM) were studied. Through AFM experiments, we confirmed the variation of electrical properties with polymer single nanowire as the controlled doping ratio (i.e., doped or de-doped states). The different distribution of electrical properties for π -conjugated polymer single nanowire in different positions were observed.