

Volume Changes of Polypyrrole Investigated Using Strain Gages and In-Situ Scanning Tunneling Microscopy

표명호

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Strain changes of polypyrrole (PPy) during electropolymerization and redox (reduction and oxidation) switching in perchlorate aqueous solutions were investigated using strain gages. It was found that the magnitude of strain changes during redox switches of PPy depends on the counter cations used during electropolymerization. For PPy films of the same thicknesses, PPy synthesized in LiClO_4 demonstrated the largest strain changes during redox switching and, as the increase of cation sizes, the strain changes became smaller. Since, irrespective of the identity of counter cations, PPy showed similar strain behaviors in perchlorate solutions during redox switching, it is believed that the cations are involved in the electropolymerization process and likely to affect the formation of polymer chain structures.

We also directly investigated volume changes of polypyrrole doped with poly(styrene sulfonate) (PPy/PSS) during redox switching were investigated in aqueous solutions of various electrolytes (LiClO_4 , NaClO_4 , KClO_4 , CsClO_4), utilizing electrochemical scanning tunneling microscopy (EC-STM). PPy/PSS was synthesized on the micropatterned Au for the quantitative measurements of the film thickness variations with doping. The cationic species and the film thickness greatly affected the magnitude of the anisotropic volume change. It was also disclosed that the increase of the volume with potential scanning to the negative direction leads to the diminution of abnormal surface features, resulting in the decrease of the roughness.