Transparent and UV-Resistant Poly(3,4-ethylenedioxythiophene) Thin Films: Layer-by-Layer Assembly with Absorbing Nanoparticles

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The layer-by-layer assembly technique was used to create electrically conductive films with poly(3,4-ethylenedioxythiophene)−poly(styrene sulfonate) (PEDOT-PSS) and branched polyethylenimine (BPEI). Titanium dioxide (TiO_2) and carbon black were used to prevent UV-degradation of these PEDOT-PSS thin film assemblies. Film growth and conductivity were studied, while varying composition and examining the effect of UV absorbing particles on the electrical conductivity. All films showed similar initial sheet resistances, but after exposure to 365 nm UV light for 9 days (correlating to approximately 4 years of sunlight), the films containing TiO_2 were up to 250 times more conductive. Additionally, the TiO_2 containing films were 27% more optically transparent than films made with PEDOT in the absence of TiO_2. The addition of colloidal titania allows the useful life of the PEDOT films to be extended without the detrimental effects of decreased transparency. Doping the PEDOT with dimethylsulfoxide produced eight bilayer films that were almost 6 times more conductive. However, the degradation rate for the doped PEDOT films without TiO_2 was 10 times greater than the doped films with TiO_2.

[1] Unpublished. ISCST shall not be responsible for statements or opinions contained in papers or printed in its publications.