New Modification Approaches of Photocrosslinkable Poly (4-vinylphenol) for Low Hysteresis Organic Thin Film Transistors

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Organic thin film transistors (OTFTs) are in interest for flexible displays and low cost radio frequency identification tags (RFIDs). However, because of poor chemical resistance and instability of the organic materials against atmospheric moisture (H_2O) and oxygen (O_2), the issues of stability of OTFTs are still key hurdles for real product applications. And, the higher curing temperature for the organic gate dielectrics (OGDs) polymers causes serious problem to apply onto plastic substrate.

To suppress the hysteresis in organic thin film transistors with bottom contact structure (BC-OTFTs), we have developed new photocrosslinkable OGD polymers with low curing temperature, which are the photo-curable poly (4-vinyl phenol) (PVP) with less-hydroxyl group (-OH), and investigated the performance of BC-OTFTs using the new modified photocrosslinkable PVPs as a gate dielectric material. For the fabrication of the BC-OTFT test samples, modified PVPs were blended from OH group-less PVP resin, halogen free photoacidgenerator (PAG) and cross-linkable monomer. Gold (Au) layer was used as source/drain (S/D) electrodes which were patterned by conventional photolithography and wet etching process. Pentacene as organic semiconductor was deposited by thermal evaporation at room temperature. Any surface treatments have not performed including –silane based self-assembled monolayers (SAMs), –thiol based SAMs, and uv ozone treatment. For the understanding of hysteresis suppression mechanism, electrical and physical properties of modified PVPs have been studied by atomic force microscopy, capacitance-voltage/capacitance-frequency measurement, surface energy analysis and Fourier Transform Infrared spectroscopy (FT-IR) analysis.

We will present detail results of our new low temperature curable OGD polymers and the device performances of BC-OTFTs with the modified PVPs.