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Characterization of Soluble Fluorinated Dielectric Nanomaterials for Printed Thin Film Transistors

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Extended Abstract

Solution deposited printing process have been attracted for low cost, large-area electronic applications such as active-matrix display, electronic paper and flexible microelectronics [1]. Thin film transistor (TFT) is generally composed of electrodes, dielectrics and semiconductor layers. Printable materials for TFT have been mainly studied for electrodes and semiconductors [2], but solution-processable gate dielectric materials are relatively limited so far due to several issues such as chemical resistance and compatibility. Chemical compatibility of dielectric materials should be especially considered for the fabrication of top-gate TFT structure or multi-layered devices. Additionally, high dielectric constant insulating material is crucial to reduce the driving voltage of TFT. These technical issues lead to develop new solution based insulating materials which have both high dielectric constant and immiscibility with ordinary organic layers.

In order to solve these technical problems, high dielectric constant inorganic nanoparticles such as barium titanate were synthesized and applied fluorinated ligands to the surfaces of nanoparticles by ligand exchange [3]. These hybrid materials can be dispersed in fluorinated solvent and showed suitable coating properties for the formation of gate insulator thin films. In order to evaluate the electrical properties of fluorinated hybrid dielectric material, metal-insulator-metal diode and TFTs were fabricated using solution-processed semiconductors.

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