
Development of Thin Film Transistors using Gate Dielectric Organic-Inorganic Hybrid Layers for Chemical & Bio-sensing Applications

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This study investigated on the effects of gate dielectrics for thin film transistors (TFTs) for chemical & bio-sensing applications. The gate dielectrics were deposited using cyclohexane and tetraethyl orthosilicate (TEOS) by plasma enhanced chemical vapor deposition (PECVD) method. Silicon wafer substrate was applied to the fabrication with organic-inorganic hybrid gate dielectric.

The experiment was carried out in a homemade stainless steel PECVD system. The experimental substrates were wet-cleaned by sonication with acetone, ethyl alcohol, distilled water, and isopropyl alcohol and dried by N₂ gas blowing. Also, substrates were dry-cleaned by in-situ Ar plasma bombardment with 60 watt for 15 minute. Cyclohexane and TEOS were preheated up to 35 °C and 60 °C, respectively. Plasma power was adjusted to 20 to 60 watts and deposited. In order to make the thickness of the thin film constant, it is deposited by varying the time depending on the plasma power. Field Emission Scanning Electron Microscopy (FE-SEM) was used to measure the thickness of the plasma polymer films. Fourier-Transform Infrared (FT-IR) spectroscopy and Raman spectroscopy were used to measure the functional groups of the films. Atomic Force Microscopy (AFM) and water Contact Angle measurement were measured to study surface of plasma polymer thin films. Probestation was measured to characterize the device.