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Characterization of zinc tin oxide thin films by UHV RF magnetron co-sputter deposition

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Amorphous zinc tin oxide (ZTO) thin films are being widely studied for a variety electronic applications such as the transparent conducting oxide (TCO) in the field of photoelectric elements and thin film transistors (TFTs). Thin film transistors (TFTs) with transparent amorphous oxide semiconductors (TAOS) represent a major advance in the field of thin film electronics. Examples of TAOS materials include zinc tin oxide (ZTO), indium gallium zinc oxide (IGZO), indium zinc oxide, and indium zinc tin oxide. Among them, ZTO has good optical and electrical properties (high transmittance and larger than 3eV band gap energy). Furthermore ZTO does not contain indium or gallium and is relatively inexpensive and non-toxic.

In this study, ZTO thin films were formed by UHV RF magnetron co-sputter deposition on silicon substrates and sapphires. The films were deposited from ZnO and SnO2 target in an RF argon and oxygen plasma. The deposition condition of ZTO thin films were controlled by RF power and post anneal temperature using rapid thermal annealing (RTA). The deposited and annealed films were characterized by X-ray diffraction (XRD), atomic force microscope (AFM), ultraviolet and visible light (UV-VIS) spectrophotometer.

Keywords: Thin film, sputtering, zinc tin oxide, ZTO

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One step facile synthesis of Au nanoparticle-cyclized polyacrylonitrile composite films and their use in organic nano-floating gate memory applications

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In this study, we synthesized Au nanoparticles (AuNPs) in polyacrylonitrile (PAN) thin films using a simple annealing process in the solid phase. The synthetic conditions were systematically controlled and optimized by varying the concentration of the Au salt solution and the annealing temperature. X-ray photoelectron spectroscopy (XPS) confirmed their chemical state, and transmission electron microscopy (TEM) verified the successful synthesis, size, and density of AuNPs. Au nanoparticles were generated from the thermal decomposition of the Au salt and stabilized during the cyclization of the PAN matrix. For actual device applications, previous synthetic techniques have required the synthesis of AuNPs in a liquid phase and an additional process to form the thin film layer, such as spin-coating, dip-coating, Langmuir-Blodgett, or high vacuum deposition. In contrast, our one-step synthesis could produce gold nanoparticles from the Au salt contained in a solid matrix with an easy heat treatment. The PAN:AuNPs composite was used as the charge trap layer of an organic nano-floating gate memory (ONFGM). The memory devices exhibited a high on/off ratio (over 10^6), large hysteresis windows (76.7 V), and a stable endurance performance (>3000 cycles), indicating that our stabilized PAN:AuNPs composite film is a potential charge trap medium for next generation organic nano-floating gate memory transistors.

Keywords: gold nanoparticles, cyclized PAN, stabilized PAN composite, organic nonvolatile memory transistor, nano-floating gate memory