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Evaluation of Mechanical Properties of Transparent AZO(Aluminum-doped Zinc Oxide)-zincone Hybrid Multilayer Thin Films Grown on a Transparent Polyimide Substrate by Atomic and Molecular Layer Depositions

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Currently, a curved OLED(organic light-emitting diode) display is leading the smartphone market, so there is a growing interest in bendable displays. A transparent display has also attracted the attention of the smartphone market with the flexible display. To meet the required properties for the commercializing flexible and transparent display devices, the improvements of mechanical, optical and electrical properties of transparent electrodes are essential. According to previous studies, AZO-zincone hybrid layer has many advantages over conventional AZO single layer in terms of electrical properties and flexibility. In this study, the comparison of mechanical properties between conventional AZO single thin films and AZO-zincone hybrid multilayer films were performed using various characterization tools, i.e. nano-indentation, bending test and micro tensile test. Hybrid multi-layer thin films were deposited on TPI (transparent polyimide) substrate using ALD (atomic layer deposition) and MLD (molecular layer deposition) techniques. By combining these two deposition techniques, various multi-layer organic-inorganic hybrid thin film structures can be fabricated. Various layer-by-layer thin film structures were fabricated by controlling the thickness and composition of the thin films. The hybrid multi-layer thin films show great potential for future high-end bendable display technologies due to their tunable mechanical, optical and electrical properties based on multi-layer thin structures.

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