Evaluating Zinc Oxide-Doped Aluminum Oxide (AZO) as a New Dielectric Material to Develop Highly Efficient Transparent Thin Film Transistors

Amer, Doha (School: Dar AlFikr Schools)

As the use of transistors have proliferated in electronic devices, much attention has been granted to the area of research in increasing their efficiency. Thin film transistors (TFT) are implemented in displays of different sizes. Current displays possess different types of backlight. These backlights have high power consumption and manifest dimming issues. This project proposes that doping aluminum oxide with zinc oxide in the dielectric layer of a TFT increases the stability, mobility, and ON/OFF current ratio creating a more efficient transparent TFT. To study the performance of zinc oxide-doped aluminum oxide (AZO) dielectrics, this work involved the fabrication of four main TFT samples with 0, 2, 5, and 10% of ZnO dopant deposited on ITO-glass substrates. All samples underwent tests of leakage current, dielectric constants, capacitances, mobilities, turn on voltage, and bias stress stabilities. The new dielectric material was characterized through XRD and transmittance test. The TFT with 5% concentration of ZnO dopant showed the best results among the four samples with a high saturation mobility of 6.2 cm2/Vs, low turn-on voltage of -0.6V, and high transparency (~90%) in the visible range of the electromagnetic spectrum. Based on these results, it is concluded doping Al2O3 with specific concentrations of ZnO in the dielectric layer increases the efficiency of transparent TFTs, which may be sufficient for commercial use. They will enable engineers to develop transparent screens to limit their backlight power consumption.

Awards Won: