Ionically Polarized Alumina Dielectrics for Oxide-based Transistors

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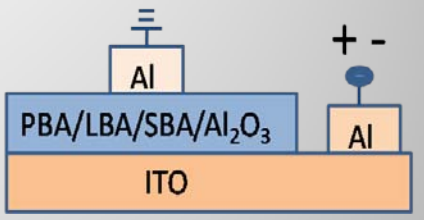
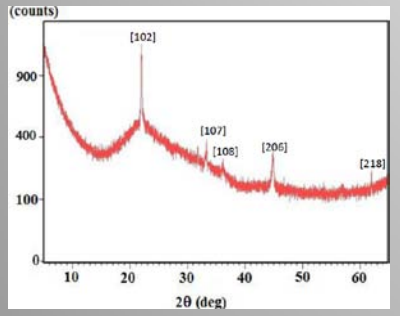
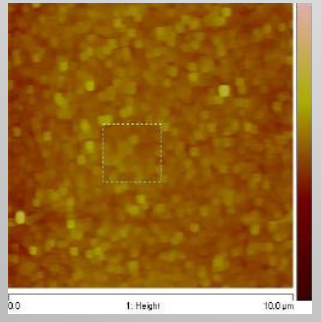
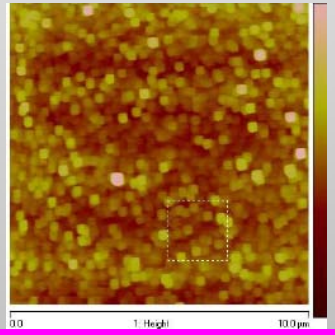
High field-effect mobility (about 20 $cm^2 \cdot V^{-1} \cdot s^{-1}$), high saturation drain current (about 1 mA), and low subthreshold swing (about 200 mV/decade) were achieved in low-voltage (2 V), spin-coated zinc-tin-oxide (ZTO) FETs with potassium beta-alumina (PBA) and lithium beta-alumina (LBA) dielectrics, as we had previously demonstrated with sodium beta-alumina . (SBA). Gate leakage currents were lower than for alumina films without ionic intercalation. The frequency, temperature, and thickness dependences of beta-alumina capacitance , and rates of ion exchange between films and solutions were determined, shedding light on the possible solid state structures of the intercalated alumina films.

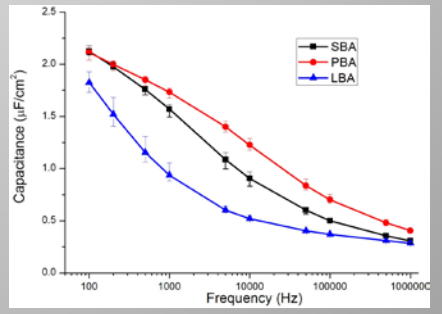


Capacitor structure

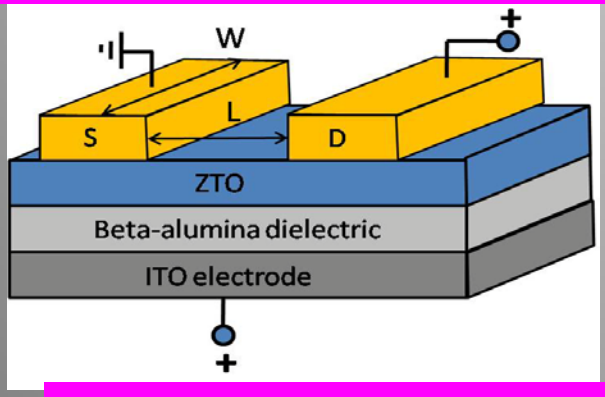


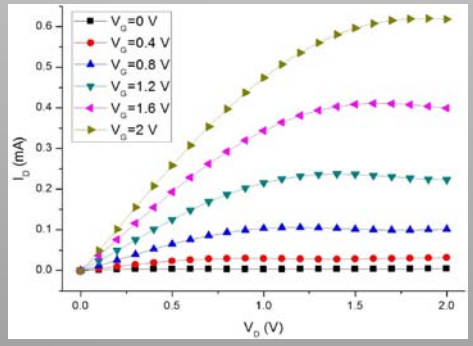




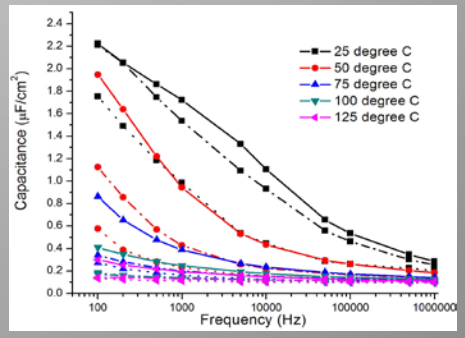


X-ray diffraction of annealed SBA, and AFM of SBA and alumina films





Oxide transistor structure and current-voltage plots



Frequency-dependent capacitance.
PBA (solid), SBA (dash dot), and LBA (dot).