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Title : FABRICATION OF NANOSTRUCTURED ZnO/MgO BILAYER WITH PVDF-TrFE LAYER FOR METAL-FERROELECTRIC-INSULATOR-METAL (MFIM) CAPACITOR APPLICATION

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The nano-MgO films, nano-ZnO films and nanostructured ZnO/MgO bilayer films were synthesized using sol-gel spin coating method. The uniform and smooth nano-ZnO film was utilized as the oxide dielectric template to produce nanostructured ZnO/MgO bilayer films. The nano-MgO films and nanostructured ZnO/MgO bilayer films were deposited at various deposition parameters (solution concentration, number of layer and annealing temperature). The effect of deposition parameters towards morphology and dielectric properties of nano-MgO films and nanostructured ZnO/MgO bilayer films was investigated. The variation of solution concentrations revealed that nano-MgO film and nanostructured ZnO/MgO bilayer film with 0.4M concentration produced improvement in the electrical properties as seen by the uniform particle distribution. The 0.4M nanostructured ZnO/MgO bilayer film showed an increment in dielectric constant, k (5.71) in comparison to 0.4M nano-MgO single layer film. Hence, 0.4M concentration was the optimized solution concentration utilized for both nano-MgO films and nanostructured ZnO/MgO bilayer films, for investigating the number of deposition layers of these films. For both films, 10 layers of MgO were found to give significant improvement in the surface properties. Most importantly, an enhancement in k value (9.70) for nanostructured ZnO/MgO bilayer film annealed at 475°C. This study has produced a novel metal-ferroelectric-insulator-metal (MFIM) capacitor configuration of ZnO/MgO/PVDF-TrFE by utilizing optimized nanostructured ZnO/MgO bilayer film as dielectric layer, with the integration of PVDF-TrFE as polymeric ferroelectric. With this novel MFIM capacitor configuration, a high electrical strength of polarization-field (P-E) hysteresis loop was obtained. In addition, the enhancement in k value (19.42) for ZnO/MgO/PVDF-TrFE film was caused by the increased in β-phase crystals in the film. This contributed to an improvement in the spontaneous polarization of ZnO/MgO/PVDF-TrFE film. Ultimately, the capacitance value obtained for ZnO/MgO/PVDF-TrFE film was significantly enhanced (35 pF) with the addition of PVDF-TrFE co-polymer film in the capacitor configuration.