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Title : FERROELECTRIC PROPERTIES OF PVDF-TRFE (70:30 mol%)/MgO NANOCOMPOSITE THIN FILM

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This research proposed study on new nanocomposite material for the application of electrical devices, which utilized fluoropolymer and nanofiller. Nanocomposite thin films with MgO loading percentages of 1, 3, 5, and 7 % incorporated in PVDF-TrFE polymer matrix were produced by spin coating technique on Al-glass substrates. The PVDF-TrFE thin films were annealed and recrystallized in accordance to the transition temperatures (T_c , T_m and T_{crys}) of PVDF-TrFE determined through the observation of the DSC spectra. The annealed PVDF-TrFE thin film (AN113) showed significant improvement in the ferroelectric properties with rectangular shape hysteresis loops for a range of applied voltage. Most importantly, the annealed AN113 film sustained electrical breakdown unlike the recrystallized thin films (RC154, RC135 and RC55). The P_r value recorded for AN113 thin film at applied voltage of 100 V was 77 mC/m², with E_c of 88 MV/m. The morphology of AN113 thin film was also observed to be defect free, as evident from FESEM images. The high intensity peaks at 1288 cm⁻¹ and 845 cm⁻¹, observed from the FTIR spectrum showed most of the dipoles in AN113 thin film were aligned parallel to the b-axis. Further annealing of PVDF-TrFE thin film at 120°C

(AN120), showed a significant increased in the P_r to a value of 93 mC/m² and E_c of 74 MV/m at 100 V applied voltage. With the incorporation of MgO nanofiller in PVDF-TrFE, the AN120/3%MgO nanocomposite thin film showed the highest P_r of 88 mC/m² with E_c of 79 MV/m at 100 V, relative to the P_r and E_c values obtained for nanocomposite thin films filled with MgO at loading percentages of 1, 5 and 7%. Further increased in MgO loading percentage, produced a drop in crystallinity, as shown by the decrement in the XRD peak diffraction at $2\theta = 19.2^\circ$. It is noteworthy to mention that from the observation of the XRD peak diffraction patterns, peak at $2\theta = 17.5^\circ$ emerged for AN120/5%MgO and AN120/7%MgO films, which indicated the presence of α phase crystals in these nanocomposite films. These unfavourable non-polar crystals have little contribution to ferroelectric properties of the nanocomposite thin films. Therefore, it is established in this study, the favourable thin film produced with enhanced ferroelectric was the annealed PVDF-TrFE thin film at 120°C and loaded with 3% MgO nanofiller.