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Polymeric nanocomposites gate dielectric for organic thin film transistors

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Nanoparticulates semiconductor oxides have played an essential role in photovoltaic devices such as field effect transistors (FET's). Organic-inorganic nanocomposites are ideal candidates which have been used as gate dielectric materials since they exhibit high dielectric constant and are low cost and easy processing materials. Zirconia nanoparticles were incorporated into poly vinyl alcohol (PVA) and ammonium dichromate and cross-linked under ultraviolet (UV) irradiation. The solution of PVAad+ZrO₂ was spun onto fluorine coated tin oxide (FTO) substrates and gold was thermally evaporated on the surface of the specimens. The obtained results demonstrated an improvement in the electrical performance of the devices when zirconia was embedded onto the polymer matrix and used as a gate dielectric. The electrical characteristics of the devices were investigated using semiconductor parameter analyzer. Current-voltage graphs showed a reduction in ideality factor after UV curing whereas the results of current-voltage curves demonstrated a remarkable enhancement in the dielectric constant of the polymeric matrix. The capacitance remained constant as the frequency increased from mHz to MHz. The micrograph images acquired from field emission scanning electron microscopy illustrated an increase in the surface roughness of the composite films owing to the compact structures of such composite films which were included dense of irregular spherical zirconia nanoparticles. Energy-dispersive X-ray spectroscopy (EDS analysis) of the devices delineated the presence of Zr, Cr, C, O, N, and Sn (due to FTO substrate). Overall, the EDS results illustrated the predominant incorporation of ZrO₂ into the polymer matrix.

Biography

Davoud Dastan has completed his MSc from Savitribai Phule Pune University. He is a PhD student at Savitribai Phule Pune University, India. He has published more than 17 papers in reputed journals and has participated at more than 30 international conferences.

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