Preparation of polymethyl methacrylate (PMMA)-carbon nanotubes (CNTs) composite by thermal polymerization for Dye Sensitized Solar Cells

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The simple thermal polymerization technique was used to prepare the novel and new carbon nanotube (CNTs)–polymethyl methacrylate (PMMA) composite and applied as composite solid electrolyte for dye sensitized solar cells (DSSCs). The thickness of CNTs was increased after polymerization of methyl methacrylate which revealed the covering of PMMA on the surface of CNTs. The surface analysis like XPS studies showed the strong interaction from the surface polar oxygen of CNT to methacrylate of PMMA molecules via partial hydrogen bonding. The Raman studies of CNT-PMMA composite electrolyte demonstrated a strong peak, indicating the formation of I_3^- ions in redox couple and lead to the high ionic conductivity of composite electrolytes. DSSCs fabricated with CNT-PMMA composite electrolytes achieved comparably high conversion efficiency 2.9% with an open circuit voltage (V_{OC}) 0.57 V, short circuit current density (J_{SC}) 8.9 mA/cm^2 and fill factor 61.8% which resulted from the increased amorphicity and ionic conductivity of CNT-PMMA composite electrolytes.