

Electrochemical synthesis and characterization of poly (3 methyl thiophene) and its evaluation as electrode material for photovoltaic devices

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Poly (3-methyl thiophene) films were prepared by electrochemical polymerization with different current densities ranging from $10 \mu\text{A cm}^{-2}$ to 8mA cm^{-2} and studied their optical and electrical characteristics by means of cyclic voltammetry, in-situ UV visible spectroscopy, in-situ d.c. conductivity and scanning electron micrographic techniques. The films prepared with medium current density (4mA cm^{-2}) showed higher degree of conjugation with π - π^* transition energy of 2.45 eV. The conductivity of these films at their fully oxidized state was in the order of $1 \times 10^{-3} \text{S cm}^{-1}$. As an possible practical application quasi solid photovoltaic cells have been fabricated by electrodepositioning the polymer on nanocrystalline SnO_2 films covered by a thin layer of MgO as the photoactive electrode. The cell delivered a short circuit current of $\sim 140 \mu\text{A cm}^{-2}$ with an open circuit voltage of $\sim 185 \text{mV}$ (efficiency $\sim 0.03\%$) under the irradiance of the 260W m^{-2} with a polymer electrolyte having redox couple I_3^-/I^- .