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The Role of Graphene Oxide on Titanium Dioxide Performance for Photovoltaic Applications

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Abstract : TiO_2 Graphene Oxide (TiO_2-GO) nanocomposite was prepared using the spin coating technique of suspension of Graphene Oxide (GO) nanosheets and Titanium Tetra Isopropoxide (TIP). The prepared nanocomposites samples were characterized by X-ray diffractometer, Scanning Electron Microscope and Atomic Force Microscope to examine their structures and morphologies. UV-vis transmittance and reflectance spectroscopy was employed to estimate band gap energies. From the TiO_2-GO samples, a 0.25 µm thin layer on a piece of glass 2x2 cm was created. The X-ray diffraction analysis revealed that the as-deposited layers are amorphous in nature. The surface morphology images demonstrate that the layers grew in distributed with some spherical/rod-like and partially agglomerated TiGO on the surface of the composite. The Atomic Force Microscopy indicated that the films are smooth with slightly larger surface roughness. The analysis of optical absorption data of the layers showed that the values of band gap energy decreased from 3.46 eV to 1.40 eV, depending on the grams of GO doping. This reduction might be attributed to electron and/or hole trapping at the donor and acceptor levels in the TiO_2 band structure. Observed results have shown that the inclusion of GO in the TiO_2 matrix have exhibited significant and excellent properties, which would be promising for application in the photovoltaic application.

Keywords : titanium dioxide, graphene oxide, thin films, solar cells
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