ABSTRACT

To fulfil the rocketing energy demands and for the protection of natural habitat, it is need of hour to effectively utilize renewable energy resources for clean and green energy production. Among various renewable energy resources, solar energy has a huge potential to meet the future energy demands. Over the last decade, the dye sensitized solar cell (DSSC) has gained a great attention, due to an ideal compromise between efficiency and cost-performance. However, the maximum efficiency of DSSC has not achieved till time, the fundamental requirement for its commercialization. A lot of efforts has been done to maximize the efficiency of DSSC by tailoring photoanode layer. The proposed work suggests the fabrication of TiO2/graphene nanocomposites with variable weight % of graphene (0.0%, 5.0%, 10.0% and 15.0%) by a simple hydrothermal method. The composites were implanted with gold ions to a fluence 1×10 13 ions/cm2 by pelletron accelerator. The structural and physical characteristics of these nanocomposites were characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Field emission scanning electron microscopy (FESEM), Energy-dispersive X-ray spectroscopy and diffuse reflectance UV–vis spectroscopy (DR-UV-vis). The XRD results confirm the rutile crystal phase of TiO2. According to our findings from our experiments, there were no structural phase transitions caused by adding Au and graphene to any of the synthetic composites that could be seen using X-ray diffraction (XRD). However, the incorporation of Au ions and graphene causes monotonic changes in the structural parameters. FTIR analysis reveals the formation of functional bonds. FESEM morphology exhibits the agglomerations of TiO2 particles on graphene layers and semi-spherical shape of particles. EDX analysis shows that the stoichiometric proportions of all the constituent elements were discovered, and mapping confirms the homogenous composition. The UV–Vis investigation validates the optical bandgap reduction from 3.13 eV to 2.68 eV. All these results reveal that gold implanted TiO2/graphene nanocomposites are suitable anode material for dye sensitized solar cell (DSSC) and for photocatalytic applications.