A New Methodology for Laser Reduced Graphene as a Catalyst on the Counter Electrode of Dye Sensitized Solar Cells

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Dye-sensitized solar cells (DSSCs) are promising alternatives to conventional silicon solar cells due to their ease of manufacturing, flexibility, transparency, light weight, and low light efficiency; however, the major disadvantage is the high cost of its platinum catalyst. Graphene, a thin, lightweight, single layer of carbon was tested as a platinum alternative due to its high catalytic and conductive properties and lower cost. A novel one-step methodology of laser exfoliation which reduced graphite oxide to a single layer of graphene on the DSSC counter electrode was tested and verified by scanning electron microscopy. Eight (8) DSSCs were fabricated by layering glass, fluorine doped tin oxide (FTO), titanium dioxide (TiO2), N-719 dye, electrolyte solution Z-960, a catalyst of graphene or platinum, FTO, and glass. DSSCs were tested for voltage and current under Air Mass (AM) 1.5 and 50 mW/cm2. The highest energy conversion efficiency of laser reduced graphene DSSCs was 6.31% compared to platinum at 8.63% indicating that the graphene DSSC was 73.07% as efficient as the platinum DSSC, exceeding several other published studies of graphene DSSCs. Results confirmed a new methodology of synthesizing a graphene catalyst on the counter electrode and a promising platinum alternative for dye sensitized solar cell manufacture.