Contribution ID: **208** Type: **Oral presentation**

Chemical Vapor Deposition (CVD) Synthesis of Graphite Encapsulated Magnetite Nanoparticles for Counter Electrode of Dye-sensitized Solar Cells

Thursday, May 21, 2015 9:30 AM (15 minutes)

In this project, graphite encapsulated magnetite nanoparticle in carbon matrix was synthesized using a chemical vapor deposition (CVD) and used as a counter electrode of dye-sensitized solar cells (DSSCs). The CVD reaction employed iron(III)nitrate nanohydrate and glucose as precursors, NaCl as a supporting material and methane as a carbon source. The reaction temperature was varied at 700, 750, 780 and 850 °C. The DSSC with the synthesized graphite encapsulated magnetite nanoparticle in carbon matrix counter electrode performed the highest solar cell efficiency of 4.56 %. This was higher than the DSSCs with graphite counter electrode produced by the same CVD condition and that with magnetite nanoparticle counter electrode which were 2.36 % and 1.34 %, respectively, and comparable to that of the DSSC with Pt counter electrode which was 4.72 %. The high performance of the graphite encapsulated magnetite nanoparticle in carbon matrix counter electrode was accounted for a combination of a good electrical conductivity of graphite and carbon matrix and a good catalytic property of magnetite nanoparticles.

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Session Classification: Material Physics, Nanoscale Physics and Nanotechnology

Track Classification: Material Physics, Nanoscale Physics and Nanotechnology