Facile synthesis and characterization of multi-layer graphene growth on Co-Ni oxide/Al2O3 substrate using chemical vapour deposition

ABSTRACT

The synthesis and characterization of multilayer graphene (MLG) growth on bimetallic Co-Ni oxide/Al2O3 substrate using chemical vapour deposition (CVD) were investigated. The synthesis of MLG was performed at a temperature range of 700-900 oC. Characterization was carried out using TGA, XRD, FESEM, HRTEM, EDX, XPS, FTIR, and Raman spectroscopy. The MLG growth on the bimetallic substrate was confirmed by XRD, FESEM, and HRTEM analysis. TGA and Raman spectroscopy analyses indicate the formation of thermally stable and high-quality MLG. The kinetic growth of MLG was investigated by varying the reaction temperature and monitoring the partial pressure of the ethanol (C2H5OH) as well as that of hydrogen. The data obtained were fitted to the Langmuir-Hinshelwood kinetic model for the estimation of the reaction rate constants at different temperatures. The results showed that the reaction rate constant increased with temperature and the apparent activation energy of 13.72 kJ.mol-1 was obtained indicating a relatively fast rate of MLG growth. The parity plot obtained for the comparison of the predicted and observed rate of C2H5OH consumptions showed an excellent agreement. This study is important for understanding the growth kinetics of MLG in order to develop appropriate measures that can control the production of MLG thin films for use in the electronic industries.

Keyword: Alumina; Bimetallic cobalt-nickel oxide; Chemical vapour deposition; Multi-layer graphene; Kinetics