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In-situ Synthesis of CeO2@rGO Nanocatalyst for Transesterification of Ethanol and Propylene Carbonate into Diethyl Carbonate

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Abstract

Organic carbonates have the potential to be used as fuels and because of this their production through non-phosgene routes is a thrust area of research. Di-ethyl carbonate (DEC) synthesis from propylene carbonate (PC) in the presence of alcohol is a green route. In this study, use of reduced graphene oxide (rGO) based metal oxide catalysts [rGO-MO, where M = Ce] with different amount of graphene oxide (0.2%, 0.5%, 1% and 2%) has been investigated for the synthesis of DEC by using PC and ethanol as reactants. The GO sheets were synthesized by an electrochemical process and the catalysts were synthesized using an in situ method. Theoretical study of thermodynamics of the reaction was done, which revealed that the reaction is mildly endothermic. Theoretical value of optimum temperature was found to be 420 K. The synthesized catalysts were characterized for their morphological, structural and textural properties using field emission scanning electron microscopy (FE-SEM), X-ray diffraction (XRD), N2 adsorption/desorption, thermogravimetric analysis (TGA) and Raman spectroscopy. Optimization studies were carried out to study the effect of different reaction conditions like temperature (140 °C to 180 °C), catalyst dosage (0.102 g to 0.255 g) and time (0.5 h to 5 h) on the yield of DEC. Amongst the various synthesized catalysts, 1% rGO-CeO2 gave the maximum yield of DEC.

Biography:

Navneet Kumar pursuing Ph.D in the department of Chemical engineering from Indian Institute of Technology Roorkee, India. He is working in the field of graphene metal oxide system for transesterification reaction of organic carbonate synthesis and developed two novel routes for the synthesis of graphene oxide. Currently he is focusing on the synthesis of metal free green catalyst for organic carbonate synthesis.

Speaker Publications:

1. Kumar, N.; and Srivastava, V.C. Simple Synthesis of Large Graphene Oxide Sheets via Electrochemical Method Coupled with Oxidation Process. ACS Omega 2018, 3, 10233−10242.

2. Shukla, K.; Srivastava, V.C. Efficient Synthesis of Diethyl Carbonate from Propylene Carbonate and Ethanol Using Mg−La Catalysts: Characterization, Parametric, and Thermodynamic Analysis. Ind. Eng. Chem. Res. 2018, 57, 12726−12735.

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