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Insight the influence of the catalyst basicity on glycolysis behavior of Polyethylene terephthalate (PET)

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ABSTRACT

Although polyethylene terephthalate (PET) is one of the most prevalent plastics, a cumulative disposal of PET waste has caused adverse effects on both economy and environment. Catalytic glycolysis of PET waste has emerged as a prevalent and sustainable pathway to address this problem. Due to the limitations of recovery and recycling, the catalytic development trend for PET glycolysis has recently changed from homogenous to heterogeneous designs. Herein, metal oxides with different basicity, including calcium, cerium, and cobalt, were supported on alumina and first employed in the glycolysis process of waste PET plastic. A plausible mechanism is proposed and reveals the correlation between the basicity of as-prepared catalyst and glycolysis performances. Among these catalysts, 10%Ce/Al_2O_3 exhibited a complete conversion of waste PET with the highest selectivity to the main product BHET. There is no significant drop in catalytic activity after five consecutive runs. Furthermore, the excellent quality of the monomer product BHET was confirmed via different analysis techniques. This work has contributed to a promising notion for engineering efficient heterogeneous catalysts of PET recycling technology.

1. Introduction

Polyethylene terephthalate (PET) is a thermoplastic polyester resin that possesses superior properties such as lightweight, transparency, non-toxicity, high mechanical and chemical resistance, allowing it to be widely used in the packaging industry, control panels, electrical

Abbreviations: PET, Polyethylene terephthalate; BHET, Bis(2-hydroxylethyl terephthalate); XRD, X-ray diffraction; BET, Brunauer-Emmette-Teller; BJH, Barrett-Joyner-Halenda; CO_2-TPD, Temperature-programmed desorption of CO_2; SEM-EDS, Scanning electron microscopy-Energy dispersive X-ray spectroscopy; NMR, Nuclear magnetic resonance; FT-IR, Fourier transform infrared; EI-MS, Electron ionization-Mass spectroscopy; DSC-TG, Differential Scanning Calorimetry; TGA, Thermogravimetric analysis.

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