

Catalytic fast pyrolysis of wood plastic composite over microporous zeolites

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Abstract:

The catalytic pyrolysis of commercial wood plastic composite (WPC) over microporous catalysts was investigated by thermogravimetric (TG) analysis and tandem micro reactor-gas chromatography/mass spectrometry (TMR-GC/MS). The non-isothermal TG analysis results showed that the decomposition temperatures of polyethylene and polypropylene in the WPC were shifted to lower temperatures by the use of catalysts, from 484°C to 440°C over HY(5.1), 457°C over HBeta(25), and 469°C over HZSM-5. TMR-GC/MS indicated that the formation efficiency of aromatic hydrocarbons during the catalytic pyrolysis of WPC was affected not only by the catalyst properties, but also by the contact mode between the WPC and catalyst. The in-situ catalytic pyrolysis of WPC showed a higher aromatic formation efficiency than the ex-situ reaction because of the sufficient likelihood of a reaction between the reactant molecules and catalysts during the in-situ reaction. Among the catalysts, HBeta produced the largest amount of aromatics followed by HZSM-5 and HY. Diffusion hindering of the reactant molecules to the small pores of HZSM-5 and the large amount of coke inside the large pores of HY were the main reasons for the lower aromatic formation efficiency over HZSM-5 and HY than over HBeta. Sequential catalytic TMR-GC/MS showed that the increased diffusion hindering effect caused by coke accumulation is the main limitation on the use of HZSM-5. Mesoporous HZSM-5 may be a potential way of overcoming the limitation of the catalysts used in this study.

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Frontier Labs Products used:

Tandem micro Reactor RX-3050TR