SELECTIVE PRODUCTION OF PROPYLENE FROM BIOETHANOL ON Zn/P-MODIFIED ZEOLITES ZSM-5

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Abstract. In order to increase propylene selectivity and improve the operational stability of catalysts used in the conversion of bioethanol, the HZSM-5 zeolite was modified with zinc and phosphorus. The catalysts were characterized using FTIR spectroscopy, X-ray diffraction (XRD), NH_3-TPD, BET, BJH, and SEM methods. Bioethanol conversion was carried out in a plug-flow reactor within a temperature range of 300–550°C under a nitrogen flow at a weight hourly space velocity (WHSV) of 2.0 h^{-1}. The two-component modification of HZSM-5, resulting from the partial substitution of protonic acid sites by Zn^{2+} ions and phosphate groups, led to a decrease in the density of strong acid sites, a reduction in micropore volume, and an increase in mesopore volume. These structural and acidic changes play a decisive role in enhancing propylene selectivity and suppressing side reactions associated with the condensation of unsaturated intermediates. The 3%Zn–2%P/HZSM-5 catalyst demonstrated high propylene selectivity (49.7%), C_2-C_4 olefin selectivity (79.7%), and stable catalytic performance for 80 hours at a reaction temperature of 500°C.

Keywords: bioethanol, zeolite HZSM-5, conversion, propylene, zinc, phosphorus.