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Research article

Catalytic ethylene production from ethanol dehydration over non-modified and phosphoric acid modified Zeolite H-Y (80) catalysts



Jiah Chee Soh ^a, Soo Ling Chong ^a, Sk Safdar Hossain ^c, Chin Kui Cheng ^{a,b,*}

^a Faculty of Chemical & Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang Kuantan, Pahang, Malaysia

^b Centre of Excellence for Advanced Research in Fluid Flow (CARIFF), Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang Kuantan, Pahang, Malaysia

^c Department of Chemical Engineering, King Faisal University, Al Hasa, Saudi Arabia

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ABSTRACT

The present work reports on the effects of phosphoric acid-modified Zeolite-Y towards ethylene formation from ethanol dehydration. The catalyst was impregnated with different H_3PO_4 loadings from 10 to 30 wt%. All the catalysts were characterized using N_2 -physisorption, thermogravimetric analysis, NH_3 -TPD, FTIR, SEM-EDX, X-ray diffraction and XPS techniques. The non-modified Zeolite-Y with Si/Al 80:1, H-Y (80) was found to exhibit excellent catalytic activity owing to the presence of weak acid sites that was able to protonate the hydroxyl group of ethanol. Although ethanol conversion dropped with phosphorus modified catalysts, it was found that the mod-

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Ethylene
Phosphoric acid
Zeolite-Y

catalysts can be ascribed to the reduced BET specific surface area and pore volume due to the surface coverage by layers of H_3PO_4 , consequently, hindering ethanol access to the active site. However, the spent phosphorus modified Zeolite-Y catalyst consistently showed less carbon formation compared to the undoped catalyst. This could be due to the reduction in strong acid sites and also hindering of C_2H_5OH from travelling deep into the pore networks of H-Y (80), therefore reducing the residence time with the consequence of minimizing the carbon laydown.