Tuning interactions of surface-adsorbed species over Fe−Co/K−Al_2O_3 catalyst by different K contents: Selective CO_2 hydrogenation to light olefins

Dr. Thanapha Numpilai[a,b], Dr. Narong Chanlek[c], Dr. Yingyot Poo-Arporn[c], Dr. Chin Kui Cheng[d], Nuchanart Siri-Nguan[e], Dr. Thana Sornchamni[e], Prof. Dr. Metta Chareonpanich[a,b], Dr. Paisan Kongkachuichay[a,b], Dr. Nevzat Yigit[f], Prof. Dr. Günther Rupprechter[f], Prof. Dr. Jumras Limtrakul[g], Dr. Thongthai Witoon[a,b,g]

[a] Center of Excellence on Petrochemical and Materials Technology, Department of Chemical Engineering, Faculty of Engineering, Kasetsart University, Bangkok, 10900, Thailand

[b] Research Network of NANOTEC-KU on NanoCatalysts and NanoMaterials for Sustainable Energy and Environment, Kasetsart University, Bangkok, 10900, Thailand

[c] Synchrotron Light Research Institute, Nakhon Ratchasima, 30000, Thailand

[d] Faculty of Chemical & Natural Resources Engineering, University Malaysia Pahang, Lebuhraya Tun Razak, Kuantan, Gambang, Pahang 26300, Malaysia

[e] Innovation Institute, PTT Public Company Limited, Phra Nakhon Si Ayutthaya, 13170, Thailand

[f] Institute of Materials Chemistry, Technische Universität Wien, Getreidemarkt 9/BC/01, Vienna, 1060, Austria

[g] Department of Materials Science and Engineering, School of Molecular Science and Engineering, Vidyasirimedhi Institute of Science and Technology, Rayong, 21210, Thailand

ABSTRACT

Selective CO_2 hydrogenation to light olefins over Fe−Co/K−Al_2O_3 catalysts was enhanced by tuning bonding strengths of adsorbed species by varying the content of the K promotor. Increasing the K/Fe atomic ratio from 0 to 0.5 increased the olefins/paraffins (O/P) ratio by 25.4 times, but then slightly raised upon ascending K/Fe to 2.5. The positive effect of K addition is attributed to the strong interaction of H adsorbed with the catalyst surface caused by the electron donor from K to Fe species. Although the Fe−Co/K−Al_2O_3 catalyst with K/Fe=2.5 reached the highest O/P ratio of 7.6, the maximum yield of light olefins of 16.4 % was achieved by the catalyst promoted with K/Fe of 0.5. This is explained by the considerable reduction of amount of H_2 adsorbed on the catalyst surface with K/Fe=2.5.

KEYWORDS

Carbon dioxide; Heterogeneous catalysis; Hydrogenation; K/Fe atomic ratio; Light olefins

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