Production of syngas from ethanol CO_2 reforming on La-doped Cu/Al_2O_3 : Impact of promoter loading

Shafiqah, Mohd-Nasir Nor[a]; Nguyen, Trinh Duy[b]; Jun, Lau N.[a]; Bahari, Mahadi B.[a]; Phuong, Pham T. T.[c]; Abdullah, Bawadi[d]; Vo, Dai-Viet N.[a, e]

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

[b] Center for Advanced Materials Research, Nguyen Tat Thanh University, Ho Chi Minh City, Viet Nam

[c] Institute of Chemical Technology, Vietnam Academy of Science and Technology, 1 Mac Dinh Chi Str., Dist.1, Ho Chi Minh City, Viet Nam

[d] Chemical Engineering Department, Universiti Teknologi PETRONAS, Tronoh, Perak, 31750, Malaysia

[e] Centre of Excellence for Advanced Research in Fluid Flow, Universiti Malaysia Pahang, Gambang, Kuantan, Pahang, 26300, Malaysia

ABSTRACT

Incipient wetness impregnation (IWI) method was applied to prepared 10%Cu/Al_2O_3 whereas M%La-doped 10%Cu/Al_2O_3 (Mwt%= 1%, 2%, 3%, 4% and 5%) were synthesized by employing sequential IWI technique. The prepared catalysts were evaluated from ethanol CO_2 reforming (ECR) at 1023 K and stoichiometric feed ratio. Average crystallite size of CuO particle is reduced with La-promoter addition probably caused by lanthana dilution effect that prevent agglomeration from occurring within CuO particles. H_2 reduction process produce complete CuO reduction and constant signal is appearing beyond 525 K suggests that the catalysts were completely reduced beyond that temperature. 3%La catalyst identified as optimal promoter loading based on reactant conversions. C_2H_5OH and CO_2 conversions were achieved on 3%La loading is 87.6% and 55.1%, respectively. Carbon was identified on catalyst surface based on X-ray diffraction (XRD) and scanning electron microscopy (SEM).

KEYWORDS

Cu/Al_2O_3 catalyst; Ethanol dry reforming; Hydrogen; La_2O_3; Syngas

ACKNOWLEDGMENTS

The financial assistance from Universiti Malaysia Pahang (RDU 170326 and PGRS 180368, UMP Research Grant Scheme) is fully acknowledged by the authors. Mohd-Nasir Nor Shafiqah would like to give gratitude to Master Research Scheme (MRS) from Universiti Malaysia Pahang.