Synthetic CaO-based sorbent for high-temperature CO_2 capture in sorption-enhanced hydrogen production

Piya Pecharaumporn[a], Suwimol Wongsakulphasatch[b], Thongchai Glinrun[c], Atthaphon Maneedaeng[d], Zulkafli Hassan[e], Suttichai Assabumrungrat[a]

[a] Center of Excellence in Catalysis and Catalytic Reaction Engineering, Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, 10330, Thailand

[b] Department of Chemical Engineering, Faculty of Engineering, King Mongkut's University of Technology North Bangkok, Bangkok, 10800, Thailand

[c] Department of Petrochemical and Environmental Engineering, Faculty of Engineering, Pathumwan Institute of Technology, Bangkok, 10330, Thailand

[d] School of Chemical Engineering, Institute of Engineering, Suranaree University of Technology, Nakhon Ratchasima, 30000, Thailand

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

ABSTRACT

Calcium precursor and surfactant addition on properties of synthetic alumina-containing CaO-based for CO_2 capture and for sorption-enhanced steam methane reforming process (SE-SMR) were investigated. Results showed that the sorbent derived from calcium D-gluconic acid (CG-AN) offered CO_2 sorption capacity of 0.38 g CO_2/g sorbent, which is greater than 0.17 g CO_2/g sorbent of the sorbent derived from calcium nitrate (CN-AN). Addition of CTAB surfactant during synthesis was found to enhance CO_2 sorption capacity for CG-AN but not for CN-AN sorbents. Stability tests of the modified sorbents for 10 cycles showed that CG-AN-CTAB provided higher CO_2 sorption capacity than CN-AN-CTAB for each corresponding cycle. Incorporation of CG-AN with Ni catalyst (Ni-CG-AN) using wet-mixing technique offered the longest pre-breakthrough period of 60 min for average maximum H_2 purity of 88% at 600 °C and a steam/methane molar ratio of 3.

KEYWORDS

Alumina-containing CaO-based sorbent; High-temperature CO_2 capture; Sorption-enhanced steam methane reforming; H_2 production

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