Partial oxidation of n-hexadecane over ceria-promoted catalysts derived from Ni-substituted hydrotalcite with variation of O/C ratio

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For the production of hydrogen, partial oxidation of n-hexadecane(HD) which is a representative component of diesel was carried out in a fixed-bed reactor by employing ceria-promoted Ni-substituted hydrotalcite-derived catalysts ($Ce_xNi_3Mg_3Al_2(OH)_{16}(CO_3)$; x=0.15~0.6). The volumetric feed rate of HD vapor was fixed to 1.5 cm^3(STP)/min, and that of oxygen was varied from 12 to 18 cm^3(STP)/min (the O/C ratio= 1.0~1.5). The objectives of this study were to find the optimum ceria contents and the O/C feed ratio. HD was fully converted above 973 K with no condensable products. C_3 and higher hydrocarbons formed were negligible. The O/C ratio of 1.25 in the feed was better than the ratio of 1.0 or 1.5. The catalyst with the Ce/Ni ratio of 0.3/3 showed the best H_2 yield, ~85% at 1,123 K. When the Ce/Ni ratio was higher than 0.3/3, the H_2 yield was slightly decreased. In long-term tests, ceria-promoted catalysts showed good catalytic stability for 30 h. However, when the unpromoted catalyst was used in the test, the H_2 yield was slightly decreased for 30 h.