The optimal conditions for partial oxidation of propane over ceria-promoted nickel-calcium hydroxyapatite

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The optimal conditions for partial oxidation of propane were studied to produce hydrogen in this research. Ceria-promoted nickel-calcium hydroxyapatite catalysts($Ce_xNi_{2.5}Ca_{10}(OH)_2(PO_4)_6$; x = 0.1~0.3) was employed for examining optimal content of ceria and O_2/C_3H_8 feed ratio.
With the O_2/C_3H_8 feed ratio of 1.5(ideal reaction), ceria-promoted catalysts did not exhibit higher performance than the unpromoted one. As O_2/C_3H_8 ratio was increased($O_2/C_3H_8 \geq 2.0$; i. e., supplying excess oxygen), ceria-promoted catalysts exhibited higher hydrogen yield and lower by-product(e. g., ethane, ethylene, propylene) selectivities. The optimal conditions were determined that the content of ceria(x) was 0.1 and O_2/C_3H_8 ratio was 2.0. This is considered due to the oxygen storage capacity of ceria. That is, it is considered that the highly mobile oxygen in ceria promotes the partial oxidation of propane as well as removes the deposited carbon more easily by oxidation. In durability tests, $Ce_{0.1}Ni_{2.5}Ca_{10}$ showed the highest hydrogen yield and stability.