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Catalysts for oxidative dehydrogenation of propane by CO₂, N₂O

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ABSTRACT

The work presents results on the effect of support and active component nature as well as the preparation method of oxide catalysts on their activity (C₃H₈ conversion, selectivity to C₃H₆) in the oxidative dehydrogenation of propane to propylene (ODHP): In₂O₃-Al₂O₃ (YSZ) for ODHP-CO₂ and Fe₂O₃ (Co₂O₃)/H-ZSM-5 for ODHP-N₂O.

It was shown the influence of preparation method of In₂O₃-Al₂O₃ compositions on their textural characteristics and, as a result, catalytic performance in PODH-CO₂. The hydrothermal treatment (HT) improves catalyst mesoporous structure (specific surface and volume of mesoporous), this results in higher selectivity to propylene in ODHP-CO₂ compared to catalysts prepared without HT. In the presence of In₂O₃-Al₂O₃ (HT) the highest selectivity to propylene and propylene yield are achieved for ODHP-CO₂ reaction mixture with 10 vol% CO₂. The highest propylene yield is achieved over In₂O₃/YSZ, this indicates the influence of the support nature.

The activity of oxide catalysts based on zeolites and ZrO₂ in ODHP-N₂O is depended on the nature of both the support and the active component (Fe₂O₃, Co_xO_y).

Under the conditions of twice excess of N₂O (C₃H₈+N₂O→C₃H₆+H₂O) and temperature 400 °C 39% conversion of propane, yield of propylene 21% (selectivity - 39%) are achieved. At higher temperature formation of by-products (H₂, CH₄, CO_x) was observed. In the presence of Co_xO_y/H-ZSM5 catalyst X_{C₃H₈} = 55 % and S_{C₃H₆} = 31 % are achieved at the higher temperature – 600 °C.

Keywords: In₂O₃-Al₂O₃, Fe₂O₃(Co_xO_y)/H-ZSM-5, dehydrogenation, propane, propylene

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