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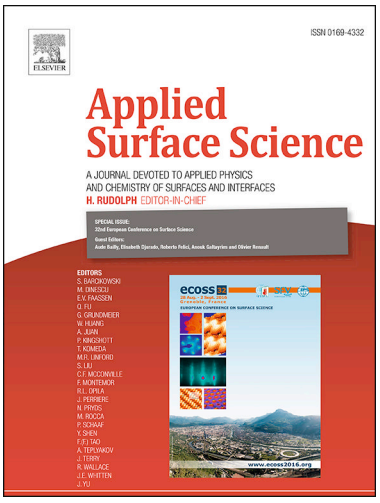

Full Length Article

Effects of the state of Co species in Co/Al_2O_3 catalysts on the catalytic performance of propane dehydrogenation

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ACCEPTED MANUSCRIPT

Effects of the state of Co species in Co/Al_2O_3 catalysts on the catalytic performance of propane dehydrogenation

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Abstract

In this paper, the Co/Al_2O_3 catalyst was prepared by incipient wetness impregnation method, and different post treatment methods were used to promote its dehydrogenation properties. Interestingly, we found that Co/Al_2O_3 catalysts with different post treatment protocols exhibited totally different catalytic behaviors in propane dehydrogenation. Fresh catalyst showed an induction period and was highly active for pyrolysis and coking at 10-30 min of reaction. The pre-reduction led to complete pyrolysis and coking at the beginning of reaction. However, the re-oxidation treatment gave a high selectivity (~93.0%) to propylene at the whole process. XRD, H_2-TPR, XPS, TEM and hydrogen chemisorption investigations showed that the post treatment has a great impact on the state of cobalt species and the performance of propane dehydrogenation over Co/Al_2O_3 catalysts. Specifically, the poorly dispersed metal Co led to pyrolysis and coking, while highly dispersed metal Co were responsible for the dehydrogenation of propane. The large Co_3O_4 particles (D_{Fresh}=33.68 nm) result in the large metal Co grains ($D_{Pre\text{-}reduced}$=24.90 nm) after the reduction or reaction process. While during the re-oxidization process, the surface metal Co was re-oxidized in a mild environment and

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