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Deactivation of industrial alumina catalyst for the skeletal isomerization of n-butenes

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Abstract

The reasons for deactivation of alumina catalyst during the skeletal isomerization of n-butenes, reducing conversion from 31 to 26%, are investigated. It is shown that contamination with metal Fe and Mg microimpurities lowers n-butene conversion in total by approximately 2.5%. The catalyst's activity can be restored by washing out metal microimpurities. Water vapor and feedstock pipelines turn out to be the source of metal impurities. The δ-modification of alumina accumulates during catalyst operation, reducing n-butene conversion by˜3 abs % and creating an irreversible type of deactivation. The drop in the tempera-ture of phase transition in the presence of Fe and Mg microimpurities is one possible reason for the partial phase transition at a temperature lower than 600°C. It is shown that the accumulation of microimpurities and the alumina δ-phase reduces the number of acid sites and thus the efficiency of alumina catalytic conversion. To prolong the catalyst's operational life, it is recommended that metal impurities be captured from the vapor-feedstock flow by installing a protective layer of a macroporous material with a developed surface inert to the butane fraction upstream of the catalyst. © Pleiades Publishing, Ltd., 2014.

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Keywords

Alumina, Catalyst deactivation, Skeletal isomerization of n-butenes