Effects of metal impregnation on the activity, selectivity and deactivation of a high silica MFI zeolite when converting methanol to light alkenes.

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Applied Catalysis, A: General (1997), 154(1-2), 117-127.

Abstract

Catalytic conversion of methanol to light alkenes was investigated using a high silica zeolite of the pentasil type MFI structure. The reaction was carried out in a fixed bed reaction set-up at 400^{o}C, WHSV = 4 h^{-1}, pressure of 1 atm, and MeOH/N_2 (wt) ratio of 2.78. The silicalite zeolite (UC-S-115) was modified by impregnation with metal nitrates of Ag, Ca, Cd, Cu, Ga, In, La and Sr to study their effects on the activity and selectivity of the catalyst to lower alkenes. Incorporation of La and Ag led to an improvement in light alkene selectivity of the silicalite by 18% and 14% respectively. This was attributed to enhanced shape selectivity of the silicalite resulting from reduction of the apparent pore size of zeolite channels. The active life-on-stream was slightly decreased due to coke deposition. A non-rigorous least square fit of the catalyst life exhibited an exponential decay as a function of coke deposition rate above 0.17 wt% h^{-1}. Below 0.17 wt% h^{-1} however, the active life-on-stream becomes insensitive to the rate of coking and is probably determined largely by catalyst intrinsic properties.