Improved catalytic performance of ZSM-5 for selective propylene-to-ethylene reaction by post-treatment with ammonium hexafluorosilicate

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Improving the product yield of zeolite catalysts over many catalytic reactions is strongly relative to the types and amounts of the acid strength in the zeolites. Herein, a selective increase of strong acidity with reduction of the weak acidity in the ZSM-5 zeolite was achieved by ammonium hexafluorosilicate (AHFS) treatment and a subsequent rinse off lightly. The modified ZSM-5 zeolite was applied as a catalyst for the olefin interconversion of propylene-to-ethylene (PTE) reaction. It showed much higher ethylene yield with similar ethylene selectivity compared to the previous reported optimum catalyst (phosphorous modified ZSM-5) during the PTE reaction. In order to find the significant changes in this catalyst, a series of modified ZSM-5 samples were prepared with different AHFS treatment conditions, and characterized the properties of catalysts using different techniques. From the combining these analyses and the results of the PTE reactions of these samples, the selective enhancement of strong acid sites in the modified ZSM-5 was found to be strongly related to remaining extra-framework aluminum species (EFALs) on the surface of the ZSM-5 catalysts after AHFS treatment.