

## Understanding the Interactions between Tetrahydrothiophene(THT) and Silver Species in AgNa-Y

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The interaction between tetrahydrothiophene (THT) and Ag species in AgNa-Y zeolites was investigated with a temperature-programmed desorption (TPD), a temperature-programmed reduction with H<sub>2</sub> (H<sub>2</sub>-TPR), a transmission electron microscopy (TEM) with an energy dispersive X-ray spectroscopy (EDX) and an X-ray absorption fine structure (XAFS). The presence of the metallic Ag and the Ag<sup>+</sup> in the fresh AgNa-Y can be supported with a TEM and an XAFS analysis. The fraction of metallic Ag in silver species increased with increasing the pretreatment temperature. The formation of Ag-S bond with concomitant decreasing the interaction between Ag<sup>+</sup> and oxygen in the lattice as well as the interaction of Ag-Ag in the metallic Ag can be observed during the adsorption of THT at ambient temperature. This can explain why there is no noticeable difference in the adsorption capacity in between Ag<sup>+</sup>-dominant AgNa-Y and Ag<sup>0</sup>-rich AgNa-Y. This Ag-S bond was transformed into the Ag-Ag bond during the heat treatment in an inert gas above 673 K. However, the fresh chemical and electronic state of Ag can be recovered after the heat treatment in air above 673 K.