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Ammonia Adsorption on Ion Exchanged Y-zeolites as Ammonia Storage Material

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Ammonia adsorption isotherm on ion exchanged Y-zeolites (Na-Y, H-Y, Co-Y, Cu-Y, K-Y, Rb-Y, and Cs-Y) was investigated to asses the potential for use in ammonia separation and storage, by measuring the adsorption isotherm at 323 to 473 K and below 1 atm.
Ammonia adsorption on Y-zeolite was increased by exchanging the cation with transition metal ions due to the increase in the number of ammonia adsorption sites with ammine complex formation, but was decreased by exchanging with alkali metal ions due to the decreased electrostatic attraction between ammonia and the zeolite surface. Irreversible ammonia adsorption sites on the ion exchanged Y-zeolite were classified into 3 types by IR (infrared) and TPD (temperature programmed desorption) techniques; $M(OH)^+$ (M: divalent cation), H^+, and M^+ (M: alkali metal ion Na^+, K^+, Rb^+, Cs^+). The first type of site bonds by ammine complex formation, the second type of site bonds by ammonium ion formation, and the third type of sites bonds by ammonia adsorption with electrostatic attraction.
Cu^{2+} exchanged Y-zeolite provided the best ammonia separation (4.92 $mmol \cdot g^{-1}$) with the temperature swing adsorption method (323-473 K, 40 kPa).

Keywords: Ammonia adsorption, Ion exchanged Y-zeolite, Ammonia storage, IR, TPD

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