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Investigating the effect of the extra-framework cation on propane / propylene adsorption in LTA zeolites

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The separation of propane and propylene remains a challenging separation process, due to the similar boiling points and size of both molecules. LTA zeolites have been shown to be promising adsorbents, but a systematic study of the effect of the extra-framework cations on propylene and propane adsorption is lacking.

In this work, we prepared LTA zeolites exchanged with different cations (Na^+ , Li^+ , Ca^{2+} , Mg^{2+} , Cu^{2+} , Mn^{2+} , Zn^{2+}). All exchanged samples were synthesized with Na^+ as counterion and then partially exchanged with the other cation (30% and 50%). Results were compared with a pure Si-LTA zeolite. Adsorption isotherms were measured using a manometric system, coupled to an isothermal microcalorimeter (Tian-Calvet type), allowing the simultaneous measurement of the released heats of adsorption. While Si-LTA shows no preferential adsorption of propane or propylene and is essentially heterogeneous for both probe molecules, propylene shows a strong interaction with divalent cations. On the other hand, LTA zeolites with monovalent cations (Na^+ / Li^+) show slow diffusion of propane, opening perspectives for a kinetic separation.

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