Zeolite recrystallization in potassium-rich hyper alkaline media

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Dissolution and recrystallization phenomena are regularly observed in zeolite synthesis, e.g. zeolite P formation upon faujasite synthesis overrun. Zeolite framework dissolution and recrystallization in alkaline media are also exploited for post-synthetic modifications, such as generation of mesopores, insertion of hetero-elements or crystal shape engineering, and for zeolite synthesis by interconversion of readily available framework types. A well-known example is the formation of chabazite (CHA) by exposure of faujasite (FAU) to KOH solution. [1] This contribution discusses the role of the connectivity of the starting framework used in this chabazite synthesis system. Gaining insight in chabazite formation and stability at high pH is essential application of chabazite as a cation-exchanger in hyperalkaline media. [2] [3]

In this work different zeolite frameworks were contacted with pure KOH solution (1 M) at 85°C. The framework types employed as the aluminosilicate source were FAU, EMT, LTA, MAZ, HEU, and KFI. All starting frameworks were synthesized with a Si/Al ratio between 2.5 and 3.5, and exchanged into the Na-form. Samples were sacrificed at different times and the solids were analyzed by PXRD, SEM, TEM, ^{29}Si and ^{27}Al MAS NMR. The composition of the liquid phase was measured by ICP-AES.

The main zeolite phase formed in each experiment was chabazite, however, the nature of the starting framework did affect the crystallinity and purity of the product. While FAU, EMT, LTA and HEU started to transform within few hours to days, KFI and MAZ did not fully transform within the timeframe of this study.

These experimental observations provide more insight in zeolite nucleation and growth, indicating CHA as a stable zeolite in the KOH system. Since zeolites have been demonstrated to dissolve by release of composite building units (CBUs), the variation of product crystallinity observed for the reported framework transformations provide more insight in the potential role of CBUs for framework assembly.

[1] Bourgogne M. *et al*. (1985) US Patent 4 503 024 [2] Van Tendeloo L. *et al*. (2015) *Environ. Sci. Technol*. **49**, 1729–1737 [3] Van Tendeloo L. *et al*. (2015) *Environ. Sci. Technol*. **49**, 2358–2365