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Structural and Thermodynamic Effects of Hydration in Na-Zeolite A (LTA) fromLow-Temperature Heat Capacity

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Zeolite A (Linde Type A; LTA) is an industrially important porous mineral that has recently been shown to exhibit framework flexibility upon changes in hydration level. To investigate the flexibility transition from a thermodynamic perspective, we have performed heat capacity measurements on sodium zeolite A at seven incremental hydration levels ranging from zero to equilibrium with ambient air. Excess low-frequency vibrations beyond the predictions of the Debye model are found in all samples, and the frequency of these vibrations increases as a function of hydration level. This suggests that an increase in hydration causes a decrease in at least one type of framework flexibility for sodium zeolite A. In addition, a subtle excess heat capacity contribution from 150 to 280 K is observed only for low and intermediate hydration levels, which may arise from a transformation tied to framework flexibility previously observed in zeolite A via gas absorption calorimetry.