

Heat capacity and thermodynamic functions of partially dehydrated sodium and zinc zeolite A (LTA)

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ABSTRACT

Zeolite A (LTA) is an industrially important zeolite that exhibits sorption-induced framework flexibility, the thermodynamics of which are poorly understood. In this work, we report heat capacity measurements on zinc and sodium zeolite A from 1.8 to 300 K and compare the heat capacity of water in sodium zeolite A with that of water in other zeolites. The heat capacity of zeolitic water varies significantly depending on the hydration level and identity of the host zeolite, and more tightly bound water exhibits strong inflections in its heat capacity curve. This suggests a combination of effects, including differences in water-framework binding strength and hydration-dependent flexibility transitions. We also report fits of the heat capacity data using theoretical functions, and we report values for C_p° , $\Delta_0^\circ T S_m^\circ$, $\Delta_0^\circ T H_m^\circ$, and Φ_m° from 0 to 300 K. These results contribute to a systematic thermodynamic understanding of the effects of cation exchange, guest molecule confinement, and sorbate-dependent flexibility transitions in zeolites.

Keywords: Zeolite, framework flexibility, gate opening, zeolitic water, heat capacity