
Thermodynamic and Structural Features of Water Sorption in Zeolites

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Abstract: The water adsorption capacity of zeolites is a function of pressure and temperature. Desorption of zeolites may be of three types, wherein the crystal lattice undergoes (1) no or little change, (2) a reversible change, or (3) an irreversible change. In the first two cases, the divariance of the zeolite-water vapor equilibrium results in networks of isobars, isotherms, and isosteres which can be transformed into a "characteristic" curve following the Polanyi-Dubinin theory. Because the volume of the micropores of a zeolite structure is constant, the isotherms and "characteristic" curve can be transformed linearly. During desorption, if the volume of the micropores varies due to a change of structure, the curves show linearity breaks.

On the basis of X-ray diffraction, differential thermal, and thermal gravimetric analyses, the equilibrium curves and structural changes of heulandite and stilbite were determined, using specially designed equipment. In the reversible adsorption range, heulandite shows no linearity breaks in the transforms and no structural variation. Stilbite, however, shows a linearity break in the transforms corresponding to a structural change.

Key Words: Heulandite • Stilbite • Thermal stability • Water sorption • Zeolite

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