

Immersion enthalpies and adsorption isotherms of liquids on carbon molecular sieves

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Liquid-phase adsorption equilibria [1, 2] are of great interest for designing energy-saving processes in industrial applications such as separation and purification. How fast the adsorption equilibrium state is reached, strongly depends on bulk diffusion effects and the adsorption kinetics of gas or liquid molecules in the pore structures of solids.

In this work, liquid immersion enthalpies and vapor adsorption isotherms of different adsorptives on series of carbon molecular sieves (CMS), called Carboxen materials, are presented. The CMS are mainly microporous with high specific BET surfaces, but they exhibit also a significant mesoporosity in order to ensure a fast kinetics to the adsorption centers in micropores.

The chosen adsorbent-adsorptive systems are going to be model systems for a new experimental device for the adsorption of binary liquid mixtures on porous and/or disperse solids. Whereas binary liquid adsorption isotherms are commonly measured by the batch method [3, 4] allowing no adsorption kinetics, the adsorption device with in-situ analytics allows measurements of the time for reaching adsorption equilibrium. The measured immersion enthalpies of pure liquids on CMS serve to give an insight into interactions at solid/liquid interfaces.

References

- [1] P. Bräuer, M. Heuchel, M. Jaroniec, *Thermodynamic Description of Interfaces*, in M. Dekker (Ed.), Encyclopedia of Surface and Colloid Science, New York, pp. 5326–5343, 2002.
- [2] D.H. Everett, *Reporting Data on Adsorption from Solution at the Solid/Solution Interface*, Pure and Appl. Chem. Vol. 58, No 7, 967-984, 1986.
- [3] R. Rockmann, G. Kalies, O. Klepel, *Liquid-phase adsorption experiments on ordered mesoporous silicas*, Adsorption 13, 515-522, 2007.
- [4] G. Kalies, R. Rockmann, D. Tuma, J. Gapke, *Ordered mesoporous solids as model substances for liquid adsorption*, Appl. Surface Sci. 256, 5395-5398, 2010.



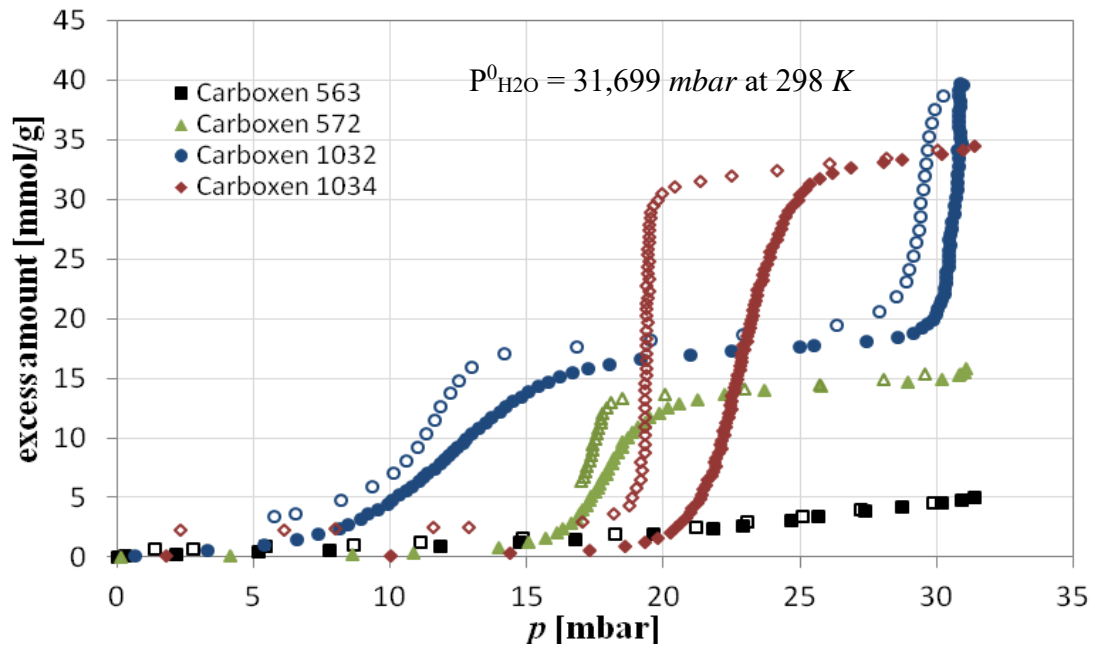


Figure 19: Vapor adsorption isotherms of water at 298 K on four different CMS; Adsorption: filled symbols, Desorption: empty symbols