

Carbon Molecular Sieves – A kinetic study

Andreas Möller^{1*}, Joachim Guderian², Marcus Lange¹, Jens Möllmer¹

¹Institut für Nichtklassische Chemie e.V., Leipzig, Germany

²CarboTech AC GmbH, Essen, Germany

*moeller@inc.uni-leipzig.de

Carbon Molecular Sieves (CMS) are unique materials which are widely used in processes based on pressure swing adsorption (PSA) for nitrogen generation by oxygen removal from air [1, 2, 3] and for the enrichment of methane from biogas or landfill gas [4]. Steadily improved CMS were launched in the last years to cover these applications. The recent materials are characterized by higher sorption capacities, compared to conventional CMS. However, in the common applications (e.g. PSA) the kinetic parameters, like kinetic selectivities etc. are the most important properties. Therefore, investigations of sorption kinetics and their temperature dependence are of great interest.

In this study, isotherms and *Uptake*-curves of CO₂, CO, O₂, N₂, H₂, Ar and CH₄ on new CMS were measured at 293 K, 313 K and 333 K. Further, Henry constants were extracted from Tòth parameters. From these constants, thermodynamic selectivities for CMS at zero coverage under equilibrium conditions were estimated and compared.

Different models, a diffusion model and a surface-resistant model were applied to describe the experimental *Uptake*-curves. In addition, kinetic selectivities were calculated from *Uptake*-curves and Henry constants and finally compared to thermodynamic selectivities. This comparison serves as a qualitative assessment for the possibility of gas separation depending on molecular size by the kinetic effect. It can be shown, that the separation performance of CMS will be much better characterized by kinetic selectivities.

References

- [1] W. Kast: *Adsorption aus der Gasphase*. VCH-Weinheim (1988)
- [2] R.T. Yang: *Gas separation by adsorption processes*. Imperial College Press, Butterworth, Boston (1987)
- [3] H.-J. Schröter: *Carbon Molecular Sieves for gas separation processes*. *Gas Separation & Purification* **7**, 247–251 (1993)
- [4] E. Pilarczyk, K.-D. Henning, K. Knoblauch: *Natural gas from landfill gas*. *Resources and Conservation* **14**, 283–294 (1987)