Diffusion of CO_2 in 5Å-zeolites by Frequency Response – Impact of assumed adsorption mechanisms

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The Frequency Response (FR) method is a powerful tool to investigate gas diffusion phenomena inside porous materials. In a typical FR experiment the gas above the sample is alternately compressed and expanded by volume modulation. The resulting pressure response contains information about the mass transport and adsorption of the gas in the sample.

The mass transport in FR experiments is always coupled with adsorption processes on the samples. Therefore it is absolutely essential to describe the kinetics of the adsorption processes as precisely as possible in order to obtain suitable diffusion coefficients.

In the current study the commercially available 5Å-zeolite KÖSTROLITH® 5ABFK was investigated with the FR method at varying CO_2 background pressures. It will be shown that standard data evaluation acording to literature leads to an unexplainable decrease of the diffusion coefficient with increasing background pressure. By the implementation of a more precise adsorption model in a quasi - single step FR model analysis, the mass transport remain consistent for the chosen background pressure range. The assumed adsorption model will be compared with the data of thermogravimetric analysis.

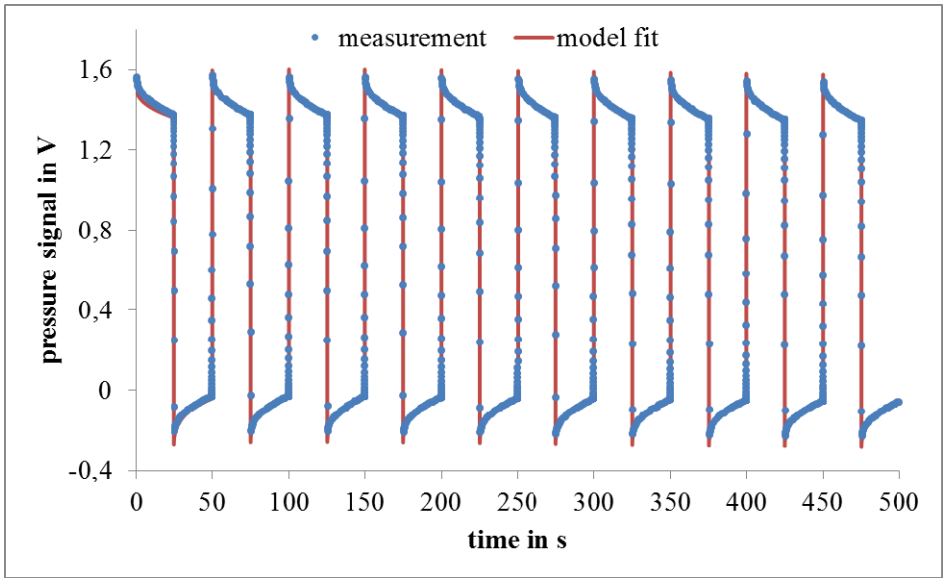

Figure 1: Example for a matched FR signal for CO_2 and 5Å-zeolite at 75°C and 1200 Pa