**Kinetics of Adsorption-Induced Deformation in Microporous Materials**

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Adsorption of fluids in porous media causes mechanical stress which results in deformation [1,2]. This phenomenon is ubiquitous, but challenging to predict quantitatively due to numerous factors (pore size and geometry, adsorbent/adsorbate combination, temperature, etc.) affecting its manifestation. Since many industrial and real-world processes occur far from thermodynamic equilibrium it is important to consider time as one of these factors. In this work, we proposed a kinetic model of adsorption-induced deformation in microporous materials. The model is based on the osmotic potential [3,4], written as a functional of two variables: strain and adsorbate concentration. From the thermodynamic potential, we constructed two differential equations describing the time evolution of the coupled processes - diffusion of adsorbate inside the porous media and the corresponding adsorbent deformation. The kinetic equations correspond to conservative and non-conservative cases, respectively. By solving them numerically we calculated spatial concentration and deformation profiles as well as their evolution. We obtained that at sufficiently low strain relaxation rates the deformation process hinders the diffusion, and becomes the limiting one. On the other hand, at high strain relaxation rates, the deformation process is defined by the local adsorbate concentration and "follows" the diffusion. We believe that the proposed model can help in the interpretation of sorption uptakes on microporous materials, including MOFs.

**References:**

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