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Studies in Thermodynamics and Humidity Development in Gas Storage Caverns

Abstract

Storing natural gas in salt caverns complex thermodynamics processes occure in which the host rock, the cavern and the wall act as coupled systems. Mathematical modelling of pressure and temperature developments is now standard engineering practice. Calculation results are verified by measured values in which the influence of the cavern wall configuration and residual brine can be taken into account.

However, the dynamics of gas humidity development in caverns still represents an area, where knowledge deficits exist. The Institute of Drilling and Fluid Mining at the Freiberg University of Mining and Technology, Germany, is running a series of studies to remedy this.

The studies are two tracks. In the fist parameters are being established to describe the process of water vapor saturation mathematically by using physical modelling based on a geometrical similar model at standard pressure and a physically similar model at high pressure and subjected to a temperature gradient. Crucial here is the mass–transfer coefficient at the brine sump/gas interface.

The second track comprises numerical modelling of the convection and diffusion processes in the cavern aided by the FLOTRAN/ANSYS software package.

By these means it is intended to be able to make statements on the optimal operating mode of a cavern (standstill time/injection strategy) as well as on possible sump treatments.