Geophysical Research Abstracts
Vol. 14, EGU2012-1783, 2012
EGU General Assembly 2012

A conversion of CO_2-ECBM related lab observations to reservoir requirements

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To predict a CBM production profile either during primary or secondary production, aspects like coal permeability and porosity, density, ash and moisture content, initial gas-in-place (GIP) (from canister desorption tests), gas sorption capacity from laboratory isotherms (to obtain gas saturations and desorption pressure), gas diffusivities, coal volumetrics (thickness and areal extent) need to be understood as a minimum requirement.
When dealing with CO_2-ECBM selective adsorption, counter diffusion in the coal matrix, or coal shrinkage and swelling (from CH4 desorption and CO_2 adsorption, respectively) and the influence of moisture need to be investigated in addition to the parameters above.
During CO_2-ECBM processes, the areal distribution of the CO_2 injected is accomplished by flow through the cleat network. When CO_2 is entering the coal matrix by a combined sorption/diffusion process it will adsorb to the coal inner surface and at the same time replace part of the CH4. This replacement occurs either by a reduction in the CH4 partial pressure or by a higher selective sorption of CO_2 over CH4. Because of a concentration gradient between CH4 in the matrix compared to the cleat system, CH4 diffuses from the coal matrix into the cleat system where, by pressure drawdown towards a production well, it can be produced.
In this context this presentation summarizes gas (CO_2, CH4) and water sorption on coal and specifically addresses the following topics:
• CH4 and CO_2 sorption capacity as a function depth and rank
• CO_2 and CH4 sorption on natural coals and its dependence on coal specific parameters like coal rank, maceral composition or ash content (Busch and Gensterblum, 2011).
• Water sorption on coal, its dependence on coal properties such as rank and coal chemistry and gas sorption in the presence of water (Busch and Gensterblum, 2011).
• N2, CH4, CO_2 displacement experiments and the volumetric response of the coal on the present gas type (sorbing or inert) in the pore system
• Uncertainties in reservoir characterisation (Gensterblum et al., 2010; Gensterblum et al., 2009)
• Sorption uptake kinetic as a function of surface coverage and the influence of moisture on the kinetic

Busch, A. and Gensterblum, Y., 2011. CBM and CO_2-ECBM related sorption processes in coal: A review. International Journal of Coal Geology, 87: 49-71.

Gensterblum, Y. et al., 2010. European inter-laboratory comparison of high pressure CO_2 sorption isotherms II: Natural coals. International Journal of Coal Geology, 84(2): 115-124.

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