Paper Number: 2701

Assessment of the total CO_2 storage capacity of shales – upscaling from sorption and reservoir data

Lutyński, M.A.[1], González G., M.Á.[1]

[1]Silesian University of Technology, Faculty of Mining and Geology, Institute of Mining, ul. Akademicka 2, 44-100 Gliwice, Poland, marcin.lutynski@polsl.pl

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Physical adsorption of carbon dioxide is becoming extremely interesting in the field of energy and environment where CO_2 emission reduction targets are a challenge for countries where fossil fuels are a dominant source of energy. Although different trapping mechanisms govern the CO_2 storage the basic idea is to inject CO_2 at high rates and permanently store it for thousands of years. The option to inject CO_2 into deep underground traps could be extended to shale gas reservoirs. In this case, CO_2 can be physically adsorbed on organic matter and/or clay minerals in the same way as methane, Fig. 1.

In order to estimate the total gas in-place, methane and CO_2 sorption measurements were performed on Polish Paleozoic shales from the Baltic basin. Sorption capacities and Langmuir parameters were used in conjunction with other physical properties from the rock and the reservoir to upscale from the laboratory measurements to the total gas in-place [1].

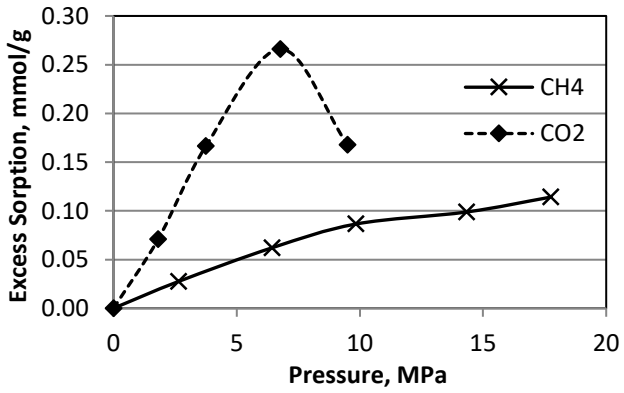

Figure 1 Example of CO2 and CH4 sorption on Polish Paleozoic shale sample at 80°C

This model takes under consideration, not only the adsorbed gas, but also the free gas stored inside the pores to give a more accurate value of the total gas in-place. It is particularly important given the fact that, unlike in coals, the ratio of adsorbed to free gas is much lower. For the calculation of the total free gas in-place, the adsorbed gas must be calculated and subtracted from this calculation and corrected for the water saturation [2].

This methodology may give a new overview on the comprehensive assessment of CO_2 storage capacity of shales as a geological trap for CO_2.

References:

[1] Kang SM et al. (2011) SPE Annual Technical Conference and Exhibition, SPE 134583

[2] Ambrose RJ et al. (2010) SPE Unconvencional Gas Conference, SPE 131722