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Permeation of CO_2 and methane in coal matrix blocks

F. Han (1,2), J. Yang (1), Z. Liu (1), A. Busch (2) and B.M. Krooss (2)

(1) State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, Chinese Academy of Sciences, Taiyuan, China, (2) Institute of Geology and Geochemistry of Petroleum and Coal, RWTH Aachen University, Aachen, Germany (han@lek.rwth-aachen.de / Fax: +49 241 8092152

The sequestration of CO_2 in unminable coal seams is considered a potential option for CO_2 geologic storage and at the same time expected to enhance the recovery of coalbed methane (CO_2-ECBM). Carbon dioxide is believed to have a stronger sorption affinity on coal surfaces compared to CH_4, resulting in an enhanced replacement of this gas. This replacement takes place in the coal matrix. Therefore, a detailed understanding of gas transport in coal matrix is crucial for processes associated with CO_2 storage and enhanced coalbed methane recovery. However, only few measurements have been reported for CO_2 permeation in the coal matrix.

In this study flow-through tests are being performed on three different coal samples from China and Poland (the latter was obtained from injection seams of the RECOPOL/MOVECBM CO_2-ECBM pilot test) with methane, CO_2 and their mixtures. For this purpose cylinders (d $<$10mm) were prepared from coal matrix blocks and used to conduct permeation tests in triaxial flow cell under defined confining P/T conditions. The relationship between CO_2 permeability and coal cylinder length was investigated. The coal cylinder had a relatively low permeability until it was sliced to a length smaller than a certain value (e.g.10mm) below which CO_2 permeability increased quickly. Gas permeability decreased with the increase of the water content in the coal cylinder.

The results of these measurements are compared and combined with those from high pressure CO_2 and CH_4 sorption experiments and coal petrological analysis (vitrinite reflectance, maceral composition). The data are further analyzed in terms of different

concepts of gas transport in coals in order to design numerical modeling tools for CO_2-ECBM reservoir simulation.