

Experimental tests and modeling of H₂S-CO₂-brine systems – a case study

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Abstract. A geochemical study aimed to determine the impact of CO₂ and H₂S, mixtures on the representative formation rocks from the Dębowiec Fm. and Paralic series of the Upper Silesian Coal Basin, and the adjacent Małopolska Block (Poland) was performed.

In the way of experiments and hydrochemical modeling the following goals were achieved: determination of the impact of acid gases on the mineralogical composition and porosity, and the assessment of mineral trapping capacity of cap rocks.

Dissolution of skeletal grains, as the dominant process (the most distinct in carbonates and chlorite) was determined by means of SEM analysis in all of the samples.

The increase in porosity at the injection stage, depending on the mineralogy of samples was caused by the decomposition of calcite and siderite or ankerite (Dębowiec Fm.), daphnite, clinocllore, and siderite (Paralic series) and hematite, ankerite, dolomite (Małopolska Block).

After 10 000 years of simulated storage, the total porosity decreased in the cap rocks by several percent points, mainly due to precipitation of saponite, muscovite, gibbsite, phlogopite and dawsonite, in favor of the rock insulating properties. Among the secondary minerals enabling the trapping of CO₂ and S in simulated storage there were observed: dolomite and pyrite (Dębowiec Fm.), dolomite, calcite and pyrite (Paralic series) and siderite, anhydrite, pyrite (Małopolska Block).

Maximum calculated mineral-trapping capacity, calculated based on the results of kinetic modeling, reached 43.4 kgCO₂/m³ and 44.9 kgS/m³ for CO₂+ H₂S co-injection into the Dębowiec Fm. Miocene rock.

Keywords: acid gas, H₂S, CO₂, geologic sequestration, gas-rock-water interactions, geochemical modeling.

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