Coal-bed methane resources have been estimated at 67 to 262 Tm³. Primary production methods produce less than 50% of the present methane. Therefore, the development of production methods with higher recovery is of great interest. An interesting option is to inject CO₂ to enhance methane production. A synergy with CO₂ storage projects is possible. Replacing CO₂ by flue gas injection avoids the expensive separation steps between CO₂ and the other components, mainly nitrogen. The separation is based on chromatographic effects. The effectiveness of enhancing methane production and CO₂ storage largely depends on the sorption behavior of the main constituents, viz. N₂, CH₄ and CO₂. The sorption isotherms of these gases have been determined at 318 K and 338 K for pressures up to 16 MPa for dry Selar Cornish coal with the manometric method. We measured both, equilibrium sorption and desorption, and also the sorption rate. The sorption rate is important as it determines the time required for attaining equilibrium between experimental steps and for the modelling of the gas exchange between cleats and coal particles. From the results it is possible to show that the sorption ratio N₂:CH₄:CO₂ = 1:1.5:2.6. This is within the range quoted in the literature. The desorption isotherms show there is no hysteresis. CO₂ shows two characteristic times, viz. one very fast and a slow one. The times to achieve the equilibrium are increasing in the order He, CO₂ fast, N₂, CH₄, CO₂ slow. The theoretical interpretation of the observed effects is based on diffusion and natural convection phenomena. The CO₂ concentration at the interface is estimated from the gas pressure using Henry’s solubility law, in which the coefficient varies with both pressure and temperature. Good agreement between the experiments and the theoretical results has been obtained.

Currently, the experiments are running on flue gas sorption on dry coal, using as a flue gas a mixture of NOₓ and CO₂. We are currently investigating for a suitable equation of state in order to estimate a correct excess sorption curve.

Experiments have been done in order to investigate the adiabatic effect connected to the fast switching of valves that lead to pressure and temperature changes. Currently a Comsol model is prepared in order to physically understand the meaning of the process.