THE ADSORPTION OF GAS BY COAL

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Successful coalbed methane exploitation requires accurate modelling of the methane adsorption isotherm, which is critical in resource estimation and determination of gas producibility.In coalbed methane exploration, the adsorption of gas by coal is often modelled using the Langmuir equation, which assumes a monolayer adsorption of the gas by the coal on an energetically homogeneous surface. Detailed analysis of the adsorption isotherm using a variety of layer-wise and pore-filling models indicates that better models are available for describing the adsorption isotherm. Furthermore, it can be shown that the Langmuir assumption of an energetically homogeneous surface is not correct for the dry coal – methane system. Analysis of multi-component gas adsorption isotherms by coals gives additional weight to the observation that the Langmuir model is incorrect for describing this system. Results obtained during the adsorption of a 50:50 mixture of methane and carbon dioxide indicate that a process of Knudsen diffusion controls the adsorption of the gases. Knudsen diffusion operates in microporous media where the mean free path of the gas molecules is only a few molecular diameters. Results from these two experiments show that application of the Langmuir equation is mechanistically incorrect for interpretation of coal – methane / carbondioxide adsorption and desorption systems.