Behavior and Permeability of Coal at Supercritical CO_2 on Different Boundary Conditions

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Micro-pilot test of enhanced coal bed methane recovery by CO_2 injection (CO_2-ECBM) for carbon dioxide capture and storage (CCS) technology was carried out for the coal bed 1000m in depth. In order to improve the low injectivity of CO_2 to a coal bed, N_2 flooding test was carried out (Fujioka, 2007), and the effect was observed. The region under strain constraint condition is formed around the CO_2 injection well. When CO_2 is injected to the strain constraint region, coal tends to swell, stress increases and the cleat is closed down. In this paper, the pore of specimen of coal was saturated with N_2 at first, CO_2 was injected under strain constraint condition, N_2 was re-injected in this, and $CO_2$was re-injected under stress constraint conditions. Strain constraint condition was achieved by confining pressure controlling with circumferential extensometer. Initial conditions were made into temperature of 35 degrees C, confining pressure 12MPa, pore pressure 10MPa and pore fluid N_2. In 1st CO_2 injection, during CO_2 was controlled by 10.2MPa and N_2 was controlled by 10.0MPa under strain constraint condition, confining pressure showed the increase from 12MPa to 18MPa rapidly. After confining pressure increases, the permeability decreased greatly. Under strain constraint conditions, since swelling of coal accompanying adsorption of CO_2, cleat is closed down. In 2nd N_2 injection, during N_2 was controlled by 10.2MPa, CO_2 was controlled by 10.0MPa under strain constraint condition, confining pressure showed the decrease from 18MPa to 12MPa gradually and permeability was recovered. In 2nd CO_2 injection, during CO_2 was controlled by 10.2MPa and N_2 was controlled by 10.0MPa under stress constraint condition, circumferential strain increased in about 7000 x 10^{-6} strain in about 3 hours. The reduction of permeability was little under stress constraint condition as compared with under strain constraint condition. Although coal adsorbs CO_2 and swells, since deformation is allowed, the cleat which is main flow path is not closed down under stress constraint conditions.