L214-P004 **Room: Poster Session Hall** **Time: May 28**

Characteristics of permeability and matrix swelling by injecting N2 and CO2 into dry coal sample

Soshi Nishimoto[1]; Tamotsu Kiyama[2]; Yoji Ishijima[2]; ziqiu xue[3]; Shigeo Yamamoto[4]; Masaji Fujioka[5]

[1] CRIEPI; [2] Horonobe RISE; [3] Kyoto University; [4] KANSO technos; [5] JCOAL

http://www.h-rise.jp/

Japan CO_2 Geosequestration in Coal Seams Project had been carried out from 2002 to 2007 by injecting CO_2 into one of Yubari coal seams, Hokkaido, Japan. It was observed that the injected amount of CO_2 decreases gradually when CO_2 is kept injecting in the coal seams. Then, when CO_2 was re-injected after N_2 was injected into the coal seams, the injected amount of CO_2 recovered temporally. In this study, we measured the change of permeability, swelling strain, and P-wave velocity (Vp) by injecting the supercritical CO_2 and N_2 into the coal sample on the dry condition in the laboratory, because the change of the permeability, strain, and elastic wave velocity by injecting CO_2 and N_2 into the coal is not understood well. In the experiments, we used the Bibai coal sample of the Sanbi Coal Mine in Hokkaido. Sample length was cut into about 50 mm diameter core and doubly polished to a length of about 125 mm. The eight strain gauges and the four piezoelectric transducers were put on the sample, and lateral strain and P-wave velocity (Vp) were measured. The strain gauges were put on the side which crosses face cleat and butt cleat at the position of 15 mm, 50 mm, 75 mm, and 110 mm from the bottom to top. The piezoelectric transducers were put on the position of 25 mm and 100 mm, and Vp values which cross with the face cleat were measured. At first, the coal sample made the vacuum under 2 MPa of confining pressure, and N_2 was injected into the pore at 0.1 MPa. Confining pressure and pore pressure were raised up to 12 MPa and 10 MPa step-by-step. Then, supercritical CO_2 was injected at 10 MPa of pore pressure under 12 MPa of confining pressure. The permeability test was carried out after breakthrough of supercritical CO_2. N_2 was re-injected into the sample after observing the change accompanying adsorption of supercritical CO_2 for the 24 hours. Similarly, the check of breakthrough, the permeability test of N_2, observation of the change by adsorption, re-injecting of supercritical CO_2, and the permeability retest were repeated. Temperature was controlled at 40 degrees C through the experiment. As a result, the strain continued swelling (+0.1%) up to 7 MPa of pore pressure, and then showed nearly constant. Similarly, Vp value increased up to 7 MPa (+6.5%) and showed nearly constant. The permeability of N_2 is from $9x10^{-4}$ darcy to $5x10^{-4}$ in the pore pressure conditions of 2 MPa to 10 MPa, and showed a little negative trend along with the increasing pressure. When supercritical CO_2 was injected into the coal sample saturated with N_2 at 0.2 MPa of the differential pressure, the rapid swelling strain of about +0.7% was measured. It is considered that N_2 is replaced with CO_2, and supercritical CO_2 adsorbs to the cleat and crack, then the whole coal swells. Since the strain values showed nearly constant in several hours, it is possible that adsorption of supercritical CO_2 is saturated comparatively for a short time. At that time, Vp increased +2.2%. The permeability of supercritical CO_2 fell to about 1/3 of N_2. Then, when N_2 was re-injected, the shrink strain of about -0.5 % was observed. Once Vp decreased greatly (-2.1%), it increased gradually with time (+1.3%). The permeability of N_2 at this time was almost the same as that of supercritical CO_2. Finally, the strain swelled about +0.5% which was equivalent to the CO_2 injection in the beginning when supercritical CO_2 was re-injected. Vp increased about +0.5%, since Vp largely increased in the N_2 re-injection phase. The Vp values were finally equal to it of the initial CO_2 injection phase. And, the significant change of the permeability in this phase could not be observed. The permeability lowering of N_2 is inferred the cleat closed by injecting CO_2 do not re-open by re-injecting N_2.