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Monitoring the Strain of Tako sandstone injected with CO2 using Optical Fiber Sensing

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CO2 capture and geological storage (CCS) is a significant technology to reduce CO2 emissions. Surface deformations around CO2 injection wells at In Salah, Algeria were analyzed by InSAR data. For the safety of CCS, it is required to ascertain the relationship between pore pressure buildup by CO2 injection and rock deformation in the depth direction. Traditional strain gauges can measure rock deformations only at installation points. However, optical fiber sensing enables us to obtain the rock deformation distribution over 20 km. In this study, we conducted the laboratory experiment to confirm that the optical fiber sensing can measure the strain of rocks.

In the experiment, we measured strain changes during injection of CO2 into water-saturated Tako sandstone. The rock sample was cylindrical and had a fine part and a coarse part. The strain changes were measured using an optical fiber and strain gauges. Strains measured by the optical fiber sensing accorded with strains of strain gauges. Strains at the coarse part were greater than strains at the fine part. The optical fiber sensing could measure physical properties of different layers. Such results suggest the possibility of monitoring the rock deformation distribution in the depth direction using the optical fiber sensing at CO2 geological sequestration sites.

Keywords: CO2 geological sequestration, porous sandstone, optical fiber sensing, strain