Detection CO_2 flooding by optical fiber; Example of a long core specimen

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We challenged the detection of CO_2 by optical fiber in a laboratory experiment using porous sandstone. We also observed the fluid movement in the specimen by performing CT image analysis at the same time. It is possible to obtain the specimen porosity and fluid saturation process by using CT image analysis. Berea sandstone (diameter: 34.85mm, length: 288mm) was used in this study. Porosity of specimen determined by X-ray CT imaging is 19.70%. This specimen has thin layers parallel to the specimen axis, and the permeability is about 130 mD. The experiment was conducted under the pressure and temperature conditions that simulate underground environments; pore pressure: 10MPa, temperature: 40 degrees Celsius. The confining pressure selected in this study is 15MPa. The specimen was first saturated with KI aqueous solution (11.5 wt%). For the CO_2 flooding, we maintained the upstream CO_2 injection rate at 0.05 mL/min. The CO_2 flooding was carried out until the total fluid injection reaches about 3PV (pore volume). Optical fiber measurement and X-ray CT imaging were performed in all experimental steps. Figure shows the detection results of CO_2 in optical fiber measurement and X-ray CT imaging. According to the results, the movement of CO_2 detected by optical fiber measurement is in good agreement with that obtained by X-ray CT. This suggests that optical fiber measurement is effective for detecting the movement of CO_2 in the rock.

Keywords: Optical fiber measurement, X-ray CT, CO2 flooding, CO2 saturation

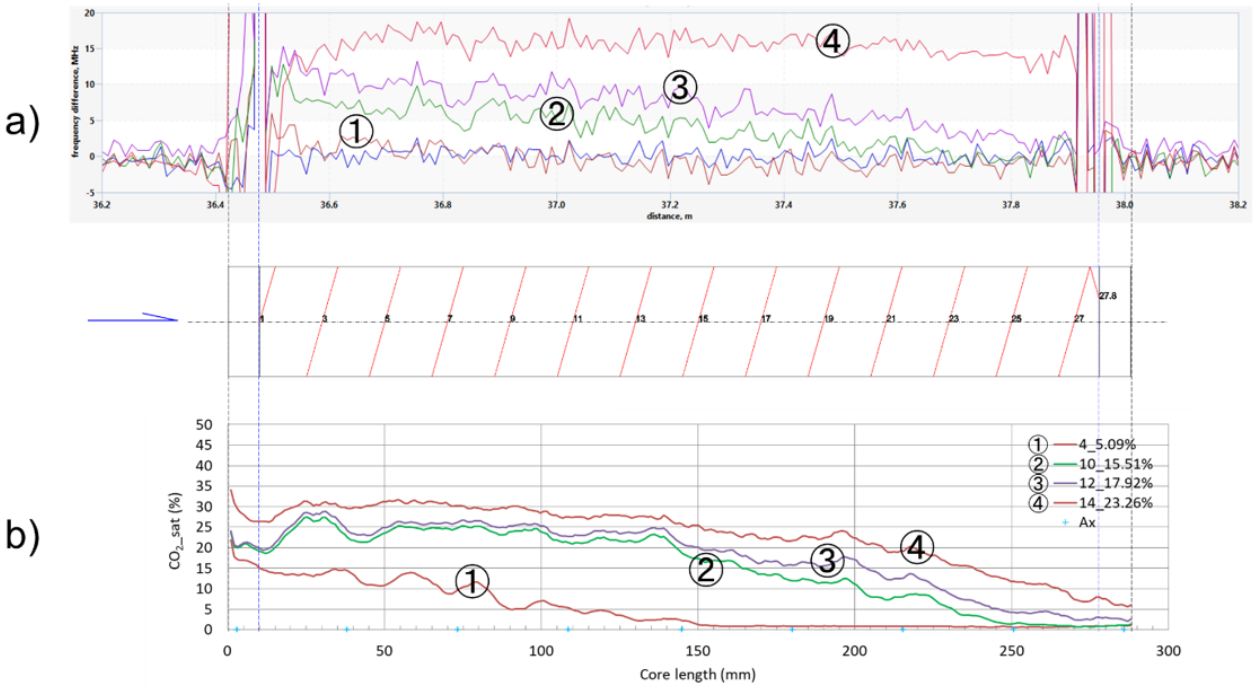

Figure. CO_2 flooding detected by optical fiber measurement and X-ray CT imaging. The circled numbers are the same point in time. a) optical fiber measurement result, b) CO_2 saturation along the specimen axial direction

