Experimental study on CO_2-rock interaction for zero emission geothermal power generation

RYOSUKE OOCHI [1], AKIRA UEDA [1] AND KENGO AOYAMA

[1] Graduate School of Science and Engineering, University of Toyama, 3190 Gofuku, Toyama-shi, Toyama 930-8555, Japan, m1541504@ems.u-toyama.ac.jp, akira@sci.u-toyama.ac.jp

[2] Okuaizu Geothermal Co., Ltd., 1034, Sunagohara, Yanaizu, Kawanuma-gun, Fukushima 969-7321, Japan, oagaoyama@oac.mitsui-kinzoku.co.jp

Several geothermal plants in the world emiited CO_2 as almost the same rate (CO_2/kwh) as fuel power plants. For promotion of zero emission geothermal power generation, it is important to examine the behavior of CO_2 after reinjection of geothermal brine into reservoir, especially for mineralization of CO_2. In Oku-Aizu geothermal area, Northeast Japan, high CO_2-rich fluids (1 vol%) with high salt concentration (Cl=6,000□14,000 mg/L) have been used for producing the geothermal electricity (65MW). This high CO_2 in the fluid is estimeted to be of volcanic origin according to the carbon-oxygen isotopic compositions of calcites in borehole samples (Oochi et al., 2014).

The final goal of our study is to advance zero emission geothermal power generation by mineralization of most of CO_2 into carobonates (Georeactor) in the reservoir after fluid injection. Several batch-type experiments on rock-CO_2 intereaction were performed at 150°C with 7g of rock samples (tuff taken from a depth of 1,691m) and 70g of distilled water for 15 days under CO_2 or Ar gas. The results show that Ca concentration in fluids with CO_2 increases rapidly after the reaction and decreases after two days. In contrast, Ca concentration in fluids with Ar gas is almost constant. These Ca behaviors are quite different from the previous report in which Ca concentration increased with time and became constant in the case of reaction with granitic rocks (Kuroda et al., 2007). In Okuaizu tuff, anhydrite is commonly observed and calcite is rare. These results imply that the differences in the behavior of Ca is due to rock types used in the reaction and that a part of Ca leached from Okuaizu tuff into the solution is fixed as calcite and anhydrite.