Basic researches for recovery of silica from geothermal fluids

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Geothermal power generation is one of the utilization of the natural energy in the world. For the safety use, however, there is still silica scale problem that we should overcome. In general, geothermal fluids becomes oversturated with respect to amorphous silica after flashing under an atomospheric pressure. Silica scale deposits from these fluids in reduction wells and pipes. To prohibit the silica scaling, silica restraint and removal methods have been examined by many reserachers but there are problems (corrosion, high cost and so on) so far. The aim of this study is to collect the oversaturated silica with cationic reageant which dose not contain any metal ions and to make the deposited silica to cosmetics.

We did the examination by the three steps; (1)Reagents addition tests to compare reagent concentration, silica concentration after the treatment, and retaining time (no retaining time:NRT and 15 minutes retaining time:15RT) in various conditions, (2)analysis of chemical and mineral compositions of the silica slurry using a X-ray fluorescence analysis (XRF) and X-ray diffraction (XRD), (3)Calculation of the sedimentation rate of the silica slurry.

We examined several experiments to collect the silica in various conditions using the cationic reagents at Sumikawa geothermal plant, Northeast Japan. The silica collection examination used the hot geothermal water from well SC-4 in which silica concentration is 1,050 mg/l. The results show that the reagents addition concentration is suitable to be ca. 50 mg/l. The silica concentration in the fluids after additon of reagent with NRT is higher than those with 15RT. This means that the reagent selectively reacts with polymer silica than monomer silica. The recovered silica is composed of mainly SiO_2 (>93%) and Na (0.5) and Al (0.2) and is in amorphous state. As for the sedimentation rate of silica slurry after reagent additon, the rate in the NRT experiment is faster than 15RT. From these field experiments, the silica concentration decreases to 400 mg/l within 1 minutes after retaining time of 15 minutes with the cationic reagent concentration of 50 mg/l.