Geochemical behavior of scale components in geothermal fluids during silica precipitation at Sumikawa geothermal plant

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In geothermal power plants, silica scale precipitates in pipes and reinjction wells and decrease the amount of reinjecting hot water. To prohibit the silica scaling, a pH adjustment method has been applied by additon of sulfuric acid. This promotes the precipitation of anhydrite ($CaSO_4$) in the production wells. Therefore, the final goal of out study is to develop the new inhibition method for silica scale. As the first step, we elucidated the occurrence of silica scale in the geothermal plant and the behavior of chemical components between hot water and silica scale.

In this study, silica scales were collected from separaters and pipies at the production and reinjection bases in Sumikawa geothermal power plant, Akita Prefecture. Scale samples were quantitatively analyzed by a X-ray fluorescence analyzer(XRF) and identified minerals contained in the scales by a X-ray diffractometer(XRD). The chemical composition of the scale were partialy analyzed by an electron probe microanalyzer(EPMA). Moreover, the saturation index of mineral in hot water was calculated using the chemical compositions to compare the observed minerals in the scale.

Scale sample is mainly made from amorphous silica with minor minerals. From the comparison of the analytical results by XRF and the hot water composition, it is found that Mg, Al, Fe, and Ca is easy to move from hot water to silica scale. In addition, from the calculated saturation index, clay minerals were estimated to be precipitated with silica due to increase of Mg concentation (o.n mg/L). From this fact, it is considered that Mg contributes to the precipitation of silica scale as well as clay minerals. In general, Al in geothermal fluid is affecting the precipitation of the silica scale. This study also demonstrates that Mg also affects the silica precipitation. Therefore, it can be expected to inhibit the precipitation of silica scale by masking Mg and Al in hot water with inhibitor.