

Speciation of Aluminum in silicic acid solution

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Introduction

In Japan, the industrial water is generally supplied from river, lake and underground water. It often contains silicic acid. Before use as the cooling water, aluminum compounds such as polyaluminum chloride (PAC) are often added into the industrial water to control the turbidity as a coagulant for water treatment. Siliceous deposits, which contain much aluminum, often precipitate from the cooling water [1]. Siliceous deposits mainly precipitate on the surface of heat exchangers and inside of pipe. They cause decline the efficiency of heat exchange and stoppage of pipe.

In this study, speciation of aluminum in silicic acid solution under the cooling system condition was studied to make clear the formation mechanism of siliceous deposits.

Experiments

Sample solutions were prepared by mixing Al (Al(NO)₃ or PAC) and silicic acid solution. Based on the Al concentration (4 ppm) and silicic acid concentration (0-150 ppm SiO₂), each sample solution symbolized as 4-0, 4-25, 4-50 and 4-150 system. All sample solutions were adjusted to pH 8.5, and stirred for 24 h at 25 °C. After that, they were filtered with four kinds of polycarbonate-made membrane filters with different pore size (5.0, 1.2, 0.4, 0.2 μm) in turn. Each filtrate was used for measurements of zeta potential, size distribution of particles including aluminum, and reactivity to ferron (coloring reagent for Al).

Results and Discussion

From the results of zeta potential measurement for particles, aluminosilicate particles are formed in 4-25, 50 and 150 systems. In addition, it is confirmed that composition of large particles is aluminosilicate, and that of small particles is abundant in aluminum compared with that of the larger particles. In the 4-25 and 50 systems, size of existing particles become smaller than other systems. From the reactivity to ferron, as the Si/Al ratio increased, the reactivity of aluminosilicate to ferron became lower.

[1] Visvanathan *et al.* (1974) *Indian J. Tec.* **12**, 221-225.

Dislocation microstructures in naturally deformed olivine crystals from Hawaiian lavas

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Petrographic and mineralogical studies of olivine-phyric Hawaiian lavas have provided fundamental insights into magma chamber processes and the evolution of Hawaiian volcanoes. They have documented complex processes such as fractional crystallization, magma mixing, and magma-wall rock interaction. These complex magmatic processes are recorded in the chemical compositions and textures of 'phenocrysts' and trapped melt inclusions. Here we report new results of a study of dislocation microstructures in olivine grains from Kilauea, Mauna Loa and Koolau lavas to interpret the crystallization processes.

Olivine crystals have a diversity of shapes, including euhedral, subhedral, anhedral and occasionally skeletal. More than 70 % of the over 3200 olivine crystals studied in lavas collected from all the three Hawaiian volcanoes have dislocation microstructures, often exhibiting dislocation densities higher than 10⁶ cm⁻². They display various patterns, including glide loops, polygonized structures, and wavy surfaces. The presence of dislocation microstructures suggests that the olivine grains have experienced high-temperature plastic deformation [1] and provides evidence for a xenocrystic origin to the olivine crystal component of the studied lavas. Both the deformed and undeformed olivines contain melt inclusions. The undeformed grains are restricted to <1 mm in size. In contrast, all grain sizes exhibit deformation. The olivine grains are therefore interpreted as xenocrystic to the host magma, but accumulated from earlier formed magma. This indicates that the entrainment of earlier crystallization products, by subsequent batches of magma of similar or different composition is a common phenomenon in the magma chambers of the Hawaiian volcanoes. Subsequently, the whole rock compositions of these (host) lavas may have been compromised and should not therefore be used as direct indicators of primary magma compositions. Lead isotopic compositions of melt inclusions in these deformed olivines will be reported in the accompanying presentation [2].

[1] Boudier (1991) *Contrib. Mineral. Petrol.* **109**, 114-123.

[2] Tanaka *et al.* (2008) *GCA*, this volume.