

High temperature In-situ TEM observation of crystallization in Sakurajima volcanic glass

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Recently, it attracts attention that the environment TEM (transmission electron microscope) holders using MEMS (Micro electro mechanical system) technique, which is one of the integrated technologies of semiconductor circuit and it is possible to in-situ and nanometer-scale observe and analyze using these environment TEM holders, e.g., heating, biasing, gas and liquid conditions.

In the present study, in-situ heating TEM experiment was carried out to observe the crystallization in volcanic glass using in-situ heating TEM holder (Wildfire D6, DENS solutions). Sample is the volcanic glass from Sakurajima volcano.

Experiment condition is that at first heating 23 degC to 1600 degC, which shows the set value, at 1 degC/sec, nextly keeping the 1160 degC for around 24 min, and finally cooling 1160 degC to 23 degC at 1 degC/sec. Because our previous temperature calibration experiments indicated that the actual temperature had the about 200 degC lower value than the setting temperature, it is thought that 1160 degC, the setting temperature in this study, showed about 950 degC.

Many minerals crystallized in volcanic glass were observed in the in-situ experiments, although we could not observe just crystallization from glass at first unfortunately. During keeping the 1160 degC, we could observe that mineral disappeared and re-crystallization. After cooling, we identified these minerals crystallized at high temperature, and these minerals were magnetite (Fe₃O₄) and clinopyroxene (space group: C2/c).

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