FeAlO$_3$ phase at ultrahigh-temperature metamorphic conditions: Evidences from the sillimanite—Fe$_2$O$_3$ and sillimanite—Fe$_3$O$_4$ systems at 9 kbar and 1050 °C

*Toshisuke Kawasaki$^1$, Tatsuro Adachi$^2$, Hiroaki Ohfuji$^1$, Yasuhito Osanai$^2$

1. Ehime University, 2. Kyushu University

Two high pressure experiments at 9 kbar and 1050 °C under moisture condition reveal FeAlO$_3$ phase is stable under ultrahigh-temperature metamorphic conditions. FeAlO$_3$ and corundum newly crystallised accompanying SiO$_2$-rich melt and vapour among sillimanite crystals from the mixture of Rundvågshetta sillimanite and reagent-grade Fe$_2$O$_3$ (weight ratio of 95:5) within Pt capsule. We found no hematite in the charge. In contrast, we found FeAlO$_3$ phase, SiO$_2$-rich melt and vapour among sillimanite from the mixture of Rundvågshetta sillimanite and reagent-grade Fe$_3$O$_4$ at (weight ratio of 86:14) within AuPd capsule. We found a domain composed by FeAlO$_3$, corundum, magnetite—hercynite spinel and ulvöspinel at the bottom part of the charge. The domain was contact with melt among sillimanite. The present results suggest the possibility that FeAlO$_3$ phase would be an index mineral of ultrahigh-temperature metamorphism for the partially melted Fe—Al-rich granulites under hydrous and oxidised environments.

Keywords: FeAlO$_3$ phase, sillimanite, corundum, spinel, ultrahigh-temperature granulites

Fig. 1. Backscattered electron image (BSEI) of run products recrystallised from the mixture of Rundvågshetta sillimanite and Fe$_2$O$_3$ in the Pt capsule (left: run no. 171018A) and the mixture of Rundvågshetta sillimanite and Fe$_3$O$_4$ in the AuPd capsule (right: run no. 171018D) at 9 kbar 1050 °C under moisture condition. Left: euhedral corundum with fine vapour hole, FeAlO$_3$ phase, glass and vapour (dark holes) fill among sillimanite crystals. Number 3 is the analysed point by Raman spectroscopy. Right: euhedral 5–10 μm size FeAlO$_3$ phase and fine (<1 μm) FeAlO$_3$ phase are scattered among sillimanite crystals accompanying melt and vapour (dark hole). Crn, corundum. FeAlO$_3$, FeAlO$_3$ phase. Gls, glass. Sil, sillimanite. V, vapour.