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Na-K inter-diffusion in (Na,K)2Si4O9 melt at 4 GPa

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Inter-diffusion experiments of Na and K in (Na,K)2Si4O9 melt under pressure was performed using KAWAI-type highpressure apparatus at ISEI of Okayama University. Experiments were designed for diffusion couple method, in which two glasses with the compositions of Na2Si4O9 and K2Si4O9 were used as starting materials. Experimental conditions were 5 GPa and 1773 K that are above liquidus of both Na2Si4O9 and K2Si4O9. To minimize the diffusion during the heating and the cooling stage, the sample temperature was rapidly increased to 1773 K from 1073 K (subsolidus condition) with raping rate 200 K/s, and after a known time lapse at desired temperature the sample was quenched to room temperature within a few seconds. Recovered sample was examined by an electron probe to determine the diffusion profile across the diffusion couple. Diffusion coefficient of Na-K inter-diffusion in (Na,K)2Si4O9 melt is calculated to be 3.4X10^-10 m^2/s at 5 GPa and 1773K. Compared with diffusion data at atmospheric pressure, we determined the activation volume of this inter-diffusion to be 10.8X10^-6m^3/mol that is close to the molar volume of potassium ion (6.9X10^-6m^3/mol).

Reference

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