Phase relations in the Fe-Ni-Si system at high pressures and high temperatures

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The Earth's core has supposed to be constituted by iron-nickel alloys with some light elements. Silicon is one of the most convincing candidates among the light elements. Therefore, the study of high pressure and high temperature properties and behaviors for the Fi-Ni-Si system is important in understanding and constraining to the properties of the Earth's core. In this study, high pressure and high temperature properties for three different contents of Fe-Ni-Si alloys were investigated by using laser heated diamond anvil cells and in situ X-ray diffraction with synchrotron radiation. We determined the phase relations of $Fe_{(0.94-x)}Ni_{0.06}Si_x$ (x = 0.10, 0.17, 0.26) up to 125 GPa and 2800 K, respectively. According to previous Fe-Si system studies, $Fe_{0.83}Si_{0.17}$ alloys transform from hcp to hcp+B2 and fcc+hcp+B2 phases with increasing temperature in isobaric conditions. We observed the change in temperature increase and positive slope of these boundaries due to the nickel containing effect and the difference in silicon content. We report the details of phase relations in the Fe-Ni-Si system and discuss with the differences from the Fe-Si system.

Keywords: Fe-Ni-Si system, phase relation, high pressure

