



Fluorescence x-ray absorption fine structure (XAFS) studies of Fe-Ni-S and Fe-Ni-Si melts to 1600 K

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We report Ni K-edge fluorescence x-ray absorption fine-structure spectra (XAFS) for $\text{Fe}_{0.75}\text{Ni}_{0.05}\text{S}_{0.20}$ and $\text{Fe}_{0.75}\text{Ni}_{0.05}\text{Si}_{0.20}$ ternary alloys from room temperature up to 1600 K. A high-temperature furnace designed for these studies incorporates two x-ray transparent windows and enables both a vertical orientation of the molten sample and a wide opening angle so that XAFS can be measured in fluorescence mode with a detector at 90° to the incident x-ray beam. Analysis of the Ni XAFS data for these two alloys indicates different local structural environments for Ni in $\text{Fe}_{0.75}\text{Ni}_{0.05}\text{S}_{0.20}$ and $\text{Fe}_{0.75}\text{Ni}_{0.05}\text{Si}_{0.20}$ melts, with more Ni-Si coordination than Ni-S coordination persisting from room temperature through melting. These results suggest that light elements such as S and Si may impact the structural and chemical properties of Fe-Ni alloys at composition similar to the Earth's core.