EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

Experiment Report Form

	Experiment title: Elastic and thermodynamic properties of FeSi at conditions of the D" layer	**Experiment number**: ES-1013
Beamline: ID18	**Date of experiment**: from: 10.03.2021 to: 17.03.2021	**Date of report**: 09.09.2021
Shifts: 21	**Local contact(s)**: Georgios Aprilis	*Received at ESRF:*

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Report:

The data generated during this experiment were used in the publication:

Mergner, V., Kupenko, I., Spiekermann, G., Petitgirard, S., Libon, L., Chariton, S., Krug, M., Steinbrügge, R., Sergueev, I., Sanchez-Valle, C., 2021. Sound Velocities in FeSi at Lower Mantle Conditions and the Origin of Ultralow-Velocity Zones. Geophys. Res. Lett. 48, 1–11. doi:10.1029/2020GL092257

Abstract:
The origin of ultralow-velocity zones (ULVZs) remains an open question despite recent advances in mineral physics and seismology. Here, we examine the hypothesis that FeSi formed from core-mantle chemical reactions is a plausible source of ULVZs at the core-mantle boundary (CMB). The sound velocities of B2-structured FeSi were measured up to 115(2) GPa and 1600(200) K by nuclear inelastic scattering (NIS) in laser-heated diamond anvil cells (LH-DACs). Within uncertainties, the sound velocities of B2-FeSi display negligible anharmonicity, hence validating the extrapolation of velocity-density relations (Birch's law) to P-T conditions of the CMB. The sound velocities of B2-FeSi are significantly lower compared to other candidate phases in a lowermost mantle assemblage, and the Preliminary Reference Earth Model at CMB conditions. Less than 8.4 vol% of FeSi in the aggregate is thus sufficient to explain both the velocity decrements and the high density anomaly observed in a wide range of ULVZs.