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Spin-glass-like behavior in $SmFeAsO_{0.8}F_{0.2}$

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Preparation of $SmFeAsO_{0.8}F_{0.2}$

A polycrystalline sample with the empirical formula $SmFeAsO_{0.8}F_{0.2}$ was prepared in a cubic anvil high-pressure cell. The sample preparation and the packing of a high-pressure cell assembly were performed in a glove box with a protective argon atmosphere. A stoichiometric mixture of high-purity (99.95%) SmAs, FeAs, Fe_2O_3, Fe, and SmF_3 powders was loaded into a boron nitride (BN) crucible and placed in a pyrophillite sample cube with a graphite furnace, which was pressurized to 3 GPa. The crucible was heated to 1350 °C for 1 h and kept at this temperature for 4.5 h; then, it was quenched to room temperature. After completing the synthesis, the pressure was released and the sample was removed. X-ray measurements revealed high homogeneity, the single phase crystalline nature of the sample, and the absence of significant amounts of impurities. The resulting sample stoichiometry was revealed by energy dispersive X-ray spectroscopy (EDX) analysis and further confirmed by X-ray structure refinement. The temperature dependence of the magnetic susceptibility of a powdered polycrystalline $SmFeAsO_{0.8}F_{0.2}$ sample of 116 mg was measured on a Quantum Design Magnetic Property Measurement System (MPMS) equipped with Reciprocating Sample Option (RSO) in an external magnetic field of 10 Oe using both ZFC and FC protocols.

Structure characterization by X-ray powder diffraction

Powder X-ray diffraction (XRD) analysis was performed at room temperature on a STOE StadiP diffractometer (CuK_α radiation, $\lambda = 1.54056$ Å). The synthesized sample was thoroughly ground in a mortar, and then the XRD pattern of the powder was measured. All peaks in the XRD pattern can be indexed based on a tetragonal unit cell (*P*4/*nmm*) of the ZrCuSiAs-type structure.

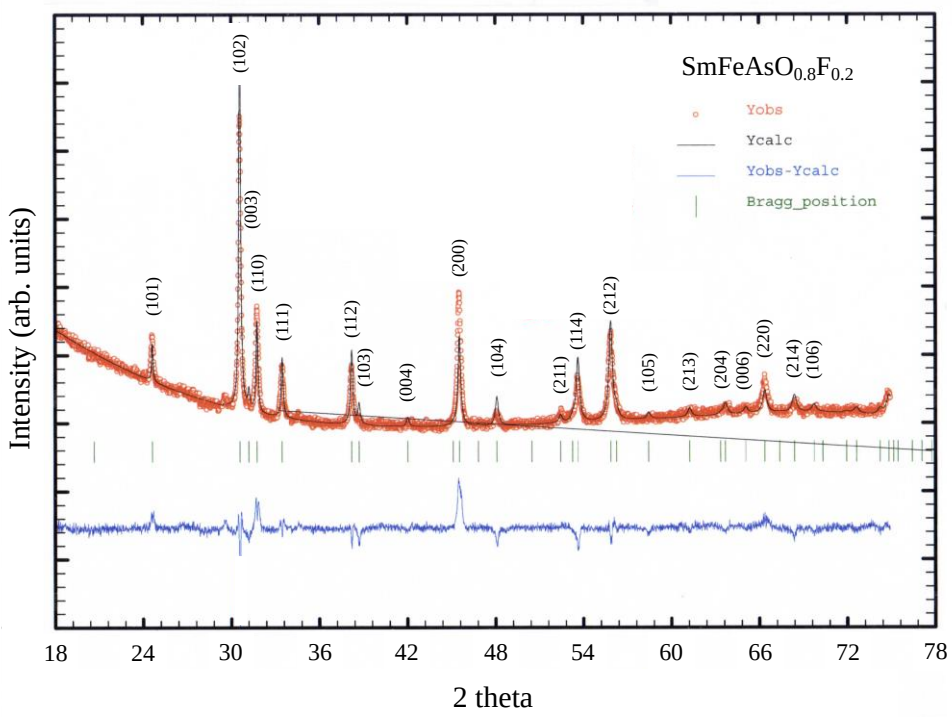


Figure S1 Observed (open circles) and calculated (line) X-ray diffraction pattern of $SmFeAsO_{0.8}F_{0.2}$ sample with the difference at the same scale plotted below. The vertical bars indicate the angular positions of the allowed Bragg reflections. The profile analysis was carried out to refine the unit cell parameters: $a = b = 3.931(1)$ Å and $c = 8.468(1)$ Å.

SEM and EDX characterization

The morphology of $SmFeAsO_{0.8}F_{0.2}$ sample and the elemental distribution within the bulk material were investigated with the Hitachi S-3000 N scanning electron microscope (SEM) equipped with a Noran SIX NSS 200 dispersive X-ray detector. Cracking the bulk sample into small parts leads to the microstructure as illustrated in Figure 2S. It is composed of stacked randomly oriented *ab*-planes of grains with dimensions up to $50 \times 50 \times 15$ μm^3.

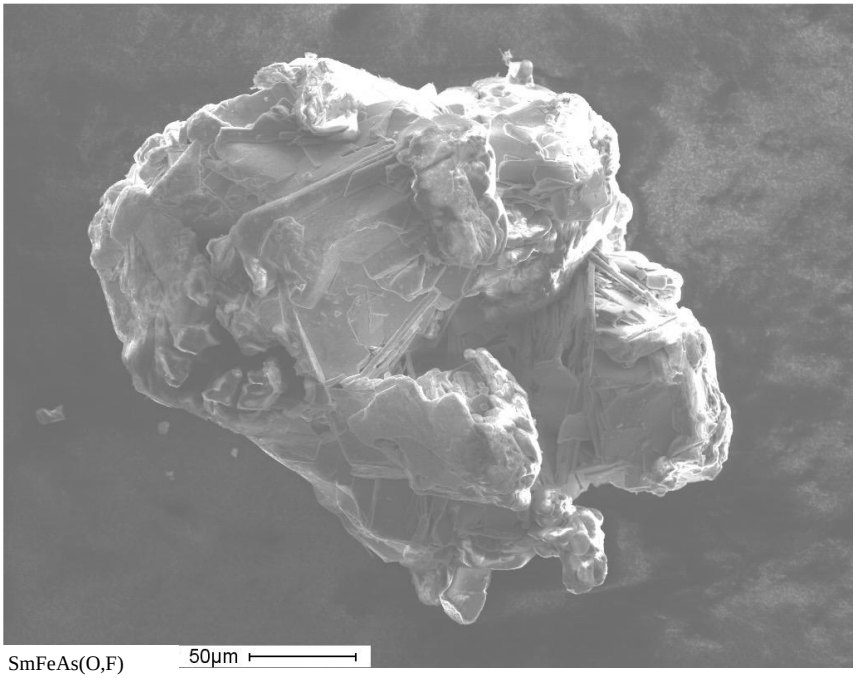
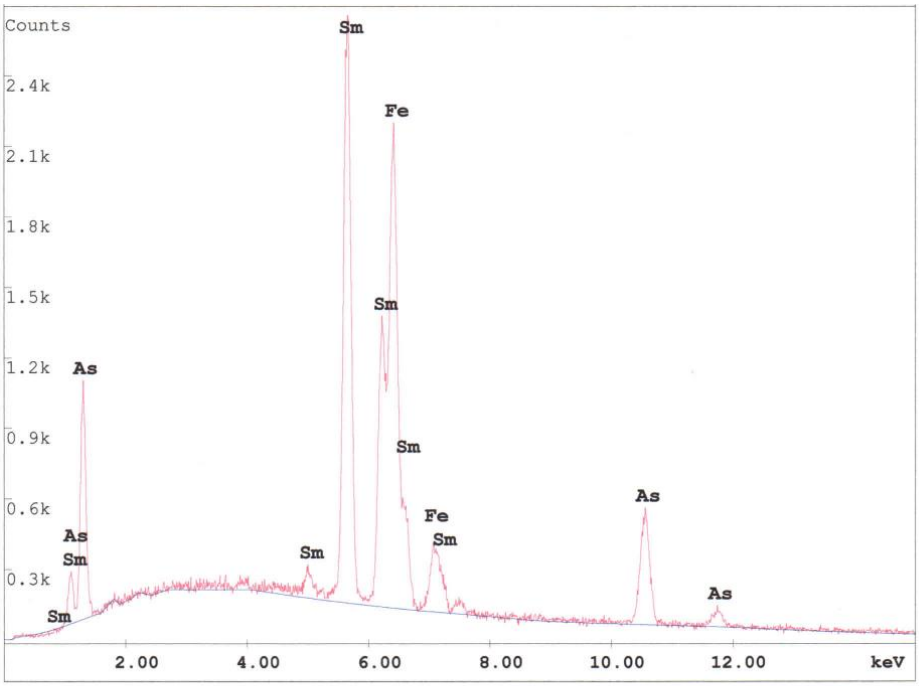


Figure S2 Electron SEM image of $SmFeAsO_{0.8}F_{0.2}$ sample showing the typical microstructure.



EDAX ZAF Quantification (Standardless)
Element Normalized
SEC Table : Default

Element	Wt %	At %	K-Ratio	Z	A	F
SmL	53.99	33.83	0.5141	0.9312	1.0226	1.0000
FeK	19.39	32.70	0.2098	1.1174	0.9620	1.0069
AsK	26.62	33.47	0.2676	1.0539	0.9537	1.0000
Total	100.00	100.00				

Element	Net Inte.	Bkgd Inte.	Inte. Error	P/B
SmL	281.01	22.10	0.64	12.72
FeK	232.33	20.38	0.71	11.40
AsK	70.79	12.15	1.38	5.83

Figure S3 Energy dispersive X-ray (EDX) analysis of $SmFeAsO_{0.8}F_{0.2}$ sample.

The resulting stoichiometry of the sample was revealed by energy dispersive X-ray spectroscopy (EDX) analysis and was further confirmed by X-ray structure refinement. Both methods show that the ratio of samarium, iron, and arsenic is equal 1:1:1, consistent with the nominal composition. The light elements of oxygen and fluorine cannot be detected accurately; therefore, for their content in the chemical formulae we quote the nominal values.