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# Enthalpies of formation of pyrrhotite $Fe_{1-0.125x}S$ ($0 \leq x \leq 1$) solid solutions

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## Abstract

Binary iron sulfides are of major interest and importance in environmental, geological, and planetary science. Oxidative high-temperature oxide melt drop-solution calorimetry in molten sodium molybdate ($3Na_2O{\cdot}4MoO_3$) solvent at 975 K was applied to determine the energetics of formation of the binary iron monosulfide solid solution (pyrrhotite) ($Fe_{1-0.125x}S$, $0 \leq x \leq 1$). The enthalpies of formation from elements are consistent with earlier data in the literature, available for a few compositions. Within the experimental errors, the enthalpies of formation of the solid solution from the end-members $Fe_{0.875}S$ and FeS ($\Delta H_{mix}$, kJ/mol) at 25 °C equal to zero. Under the assumption of random distribution of Fe vacancies, the Gibbs free energies of mixing of $Fe_{1-0.125x}S$ ($0 \leq x \leq 1$) are estimated. Our data support the two-sublattice model proposed by Waldner and Pelton (2005).

**Keywords:** Pyrrhotite, iron sulfides, thermodynamics, enthalpy of formation, oxidative high-temperature oxide melt solution calorimetry