substance: FeO ($Fe_{1-x}O$)
property: phase diagram, crystal structure

phase diagram: Fig. 1. Above 560°C a non-stoichiometric cubic phase $Fe_{1-x}O$ is stable; below this temperature $Fe_{1-x}O$ is metastable with respect to disproportionation. Smallest x value in equilibrium is 0.05, though stoichiometric FeO can be made under pressure. There is no complete solid solution range between $Fe_{1-x}O$ and Fe_3O_4, even at the highest temperature. Thermogravimetric [64V, 65V1, 65V2] and EMF measurements [69F] have suggested that several order–disorder or other higher order transitions are found in the $Fe_{1-x}O$ domain, but X-ray diffraction studies at high temperatures [72H] have failed to reveal any structural evidence for these phases.

Stoichiometric FeO can be synthesized for $T \geq 770$°C, $p \geq 36$ kbar [67K].

crystal structure

structure ($Fe_{1-x}O$): cubic, space group O_h^5 – Fm3m, $Z = 4$, above $T_N \approx 200$ K [63W].

For $T < T_N$ the structure shows a rhombohedral distortion ($\alpha < 60°$). At constant T this distortion increases as $x \rightarrow 0$ (Fig. 2). Under pressure at 300 K the value of a alters as in Fig. 3.

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Fig. 1.

$FeO–Fe_2O_3$ phase diagram [45D, 46D].

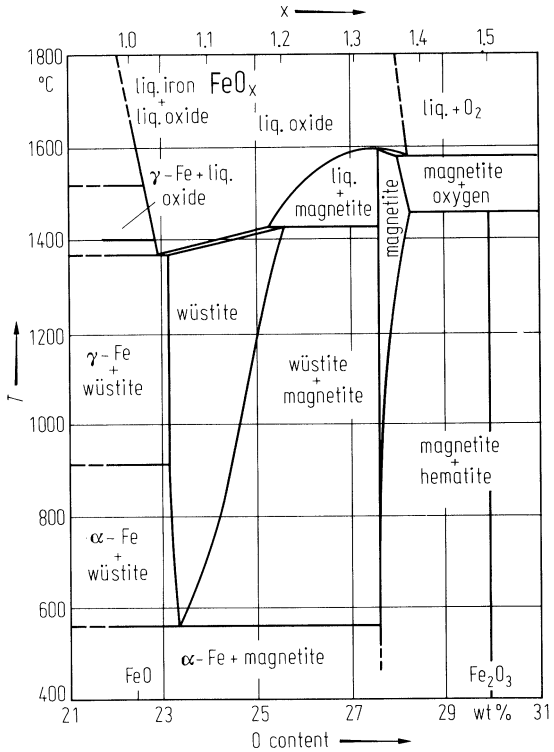

Fig. 2.

$Fe_{1–x}O$. (a) Rhombohedral distortion angle and (b) lattice constant a_{rh} as a function of cubic lattice constant a at 300 K and stoichiometry [53W, 79B]. T = 90 K.

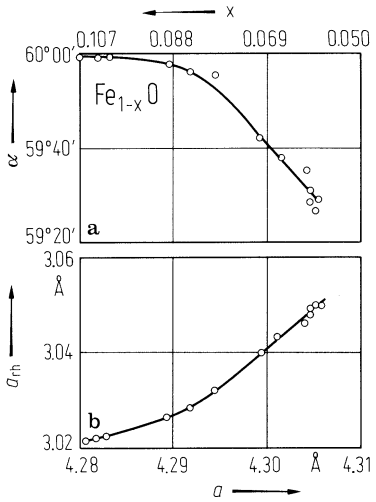

Fig. 3.

$Fe_{1-x}O$. Lattice constant vs. pressure [66C].