Co-Fe-S (Cobalt-Iron-Sulfur)

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[88Rag] reviewed the experimental data on this system and presented the reviewed results as: a liquidus projection, a reaction scheme, and isothermal sections at 800, 700, and 500 °C. Recently, [94Sor] and [97Sol] have obtained new data on equilibrium between solid alloys and the sulfide liquid.

Update

The structural transition and magnetic characteristics of $Fe_{1-x}Co_xS$ ($x < 0.25$) alloys were investigated by [87Col].

[88Vla] used the H_2-H_2S gas mixture equilibration to study the phase relationships in the Fe-FeS-CoS-Co region of the system between 500 and 850 °C. Three four-phase invariant reactions reviewed by [88Rag] were confirmed. The ternary eutectic reaction L = (Fe) + $(Fe,Co)_{1-x}S$ + Co_4S_3 was found at 842 °C (847 °C in [88Rag]). The eutectoid reaction: Co_4S_3 = (Fe) + $(Fe,Co)_{1-x}S$ + Co_9S_8 was found at 760 °C (747 °C in [88Rag]). The transition reactions U_5 of [88Rag] was found at 722 °C (~730 °C in [88Rag]). A liquidus projection and isothermal sections in the range 700 to 1000 °C were also determined by [88Vla].

[94Sor] used the interaction parameters obtained from vapor pressure measurements to compute tie lines between solid (γ) and the sulfide liquid at 1400, 1300, and 1200 °C. They found that the two-phase region becomes narrower with increasing temperature, indicating a strong metal enrichment in the sulfide liquid.

Recently, [97Sol] determined the liquidus surface and tie lines at 1350, 1300, 1250, and 1200 °C, by equilibrating the liquid sulfide phase with the solid metallic phase. Using starting materials of electrolytic purity, [97Sol] studied the liquid-solid equilibria with atomic absorption spectroscopy and EPMA.

Figures 1 and 2 show their isothermal sections at 1350 and 1200 °C with tie lines. These results confirm those of [94Sor] with regard to the strong metal enrichment in the sulfide liquid with increasing temperature. However, they indicate a slower decrease in the S content of the liquid with increasing temperature than that computed by [94Sor].

Cited References

87Col: G. Collin, M.F. Gardette, and R. Gomes, "The $Fe_{1-x}Co_xS$ ($x < 0.25$); Transition and the High Temperature Phase," *J. Phys. Chem Solids, 48*(9), 791-802 (1987). (Experimental).

88Rag: V. Raghavan, "The Co-Fe-S System," *Phase Diagrams of Ternary Iron Alloys. Part 2,* Indian Institute of Metals, Calcutta, 93-106 (1988). (Review; #)

88Vla: K.C. Vlach, "A Study of Sulfur Pressures and Phase Relationships in the Fe-FeS-Co-CoS and Fe-Cr-S Systems," Ph.D. thesis, Univ. Wisconsin, Madison, 188 pages (1988). (Experimental; #)

94Sor: M.L. Sorokin, A.G. Nikolaev, and V.P. Bystrov, "Thermodynamics of the Co-Fe-S System," *Tsvetn. Met.,* (12), 17-21 (1994) in Russian; TR: *Russ. J. Nonferrous Met.,* (12), 6-10 (1994). (Review; #)

97Sol: M. Soltaneih, J.M. Toguri, and R. Sridhar, "The Liquidus Surface and Tie-Lines in the Fe-Co-S System between 1473 and 1623 K," *Metall. Mater. Trans. B, 28B,* 647-650 (1997). (Experimental; #)

# Indicates presence of a phase diagram

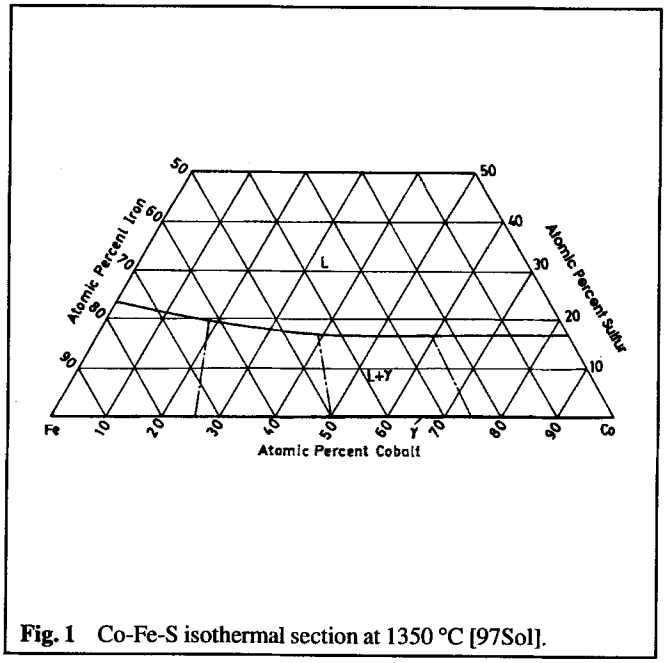

Fig. 1 Co-Fe-S isothermal section at 1350 °C [97Sol].

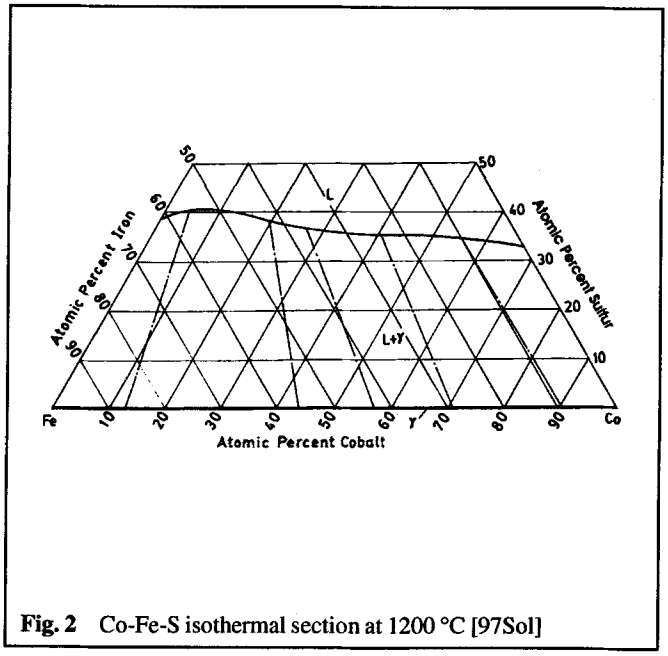

Fig. 2 Co-Fe-S isothermal section at 1200 °C [97Sol]