

# Al-Fe-O (Aluminum-Iron-Oxygen)

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The early results on this ternary system were reviewed by [1989Rag], with emphasis on the phase equilibria at metal saturation. The review presented isothermal sections at 1500, 1380, 1280, 900 and 700 °C and a hypothetical liquidus projection and reaction scheme. Recently, [2004Han] and [2009Rha] investigated the pseudo-binary section in air along the  $\text{Fe}_2\text{O}_3$ - $\text{Al}_2\text{O}_3$  join.

## Binary Systems

In the Al-O system, there is one intermediate compound corundum ( $\alpha\text{Al}_2\text{O}_3$ ;  $D5_1$ -type rhombohedral), which melts congruently at 2054 °C. The Fe-O phase diagram [1991Wri] exhibits the following compounds. Wustite (FeO) is a metal-deficient monoxide with the  $B1$ , NaCl-type cubic structure. Magnetite ( $\text{Fe}_3\text{O}_4$ ) has the  $H1_1$ ,  $\text{Al}_2\text{MgO}_4$ -type cubic structure. Hematite ( $\alpha\text{Fe}_2\text{O}_3$ ) is  $D5_1$ -type rhombohedral. Other less-common polymorphic forms of the above compounds are known [1991Wri].

## The $\text{Fe}_2\text{O}_3$ - $\text{Al}_2\text{O}_3$ Pseudo-Binary Section in Air

With starting powders of  $\text{Fe}_2\text{O}_3$  and  $\text{Al}_2\text{O}_3$  of 99.5+% purity, [2004Han] pelletized powder mixtures and equilibrated them in air at temperatures between 1550 and 1100 °C. The microstructures were examined with optical and scanning electron microscopy. The phase compositions were measured by electron probe microanalysis (EPMA). With starting powders of 99.98%  $\text{Fe}_2\text{O}_3$  and 99.99%  $\text{Al}_2\text{O}_3$ , [2009Rha] equilibrated a limited number of pellets between 1400 and 1200 °C and measured the compositions of the co-existing phases by EPMA. Figure 1 shows the pseudo-binary section in air along the  $\text{Fe}_2\text{O}_3$ - $\text{Al}_2\text{O}_3$  join, incorporating the results of [1956Mua], [2004Han] and [2009Rha]. The ternary phase  $\text{Fe}_2\text{Al}_2\text{O}_6$  is stable between 1410 and 1318 °C [1956Mua]. The results of [2004Han] and [2009Rha] indicate a larger solubility of  $\text{Al}_2\text{O}_3$  in hematite than that found by [1956Mua].

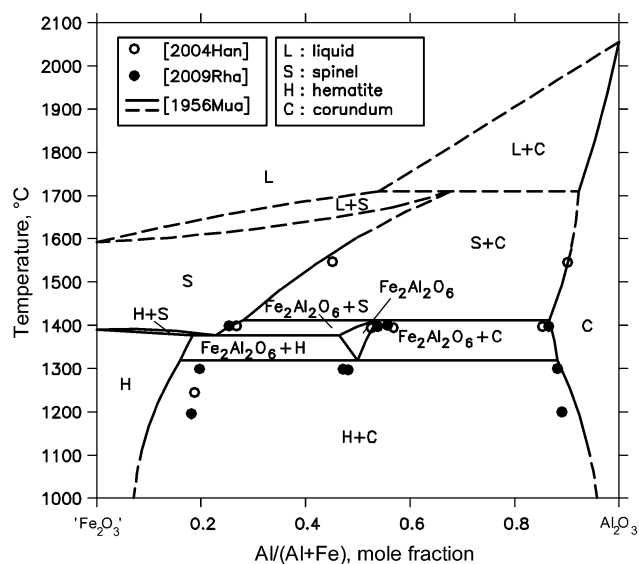


Fig. 1 Al-Fe-O pseudo-binary section in air along the  $\text{Fe}_2\text{O}_3$ - $\text{Al}_2\text{O}_3$  join

## References

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