

# Fe-P-Zn (Iron-Phosphorus-Zinc)

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The previous review of this ternary system by [1988Rag1] presented an isothermal section at 750 °C from the studies of [1953Vog] and a tentative reaction scheme. Recently, [2008Li] determined an isothermal section at 450 °C.

## Binary Systems

The partial Fe-P phase diagram reviewed by [1988Rag2] shows three intermediate phases: Fe<sub>3</sub>P (*D0<sub>e</sub>*, Ni<sub>3</sub>P-type tetragonal), Fe<sub>2</sub>P (*C22*, Fe<sub>2</sub>P-type hexagonal), and FeP (*B31*, MnP-type orthorhombic). The Fe-Zn phase diagram [2005Nak] depicts the following intermediate phases:  $\Gamma$  (Fe<sub>3</sub>Zn<sub>10</sub>; Cu<sub>5</sub>Zn<sub>8</sub>-type cubic),  $\Gamma_1$  (Fe<sub>11</sub>Zn<sub>40</sub>; cubic, space group *F43m*, 408 atoms/cell),  $\delta$  (FeZn<sub>10</sub>; FeZn<sub>10</sub>-type hexagonal), and  $\zeta$  (CoZn<sub>13</sub>-type monoclinic). In the Zn-P partial phase diagram [1988Rag1], the intermediate phases are:  $\beta$ Zn<sub>3</sub>P<sub>2</sub>,  $\alpha$ Zn<sub>3</sub>P<sub>2</sub> (*D5<sub>9</sub>*, Zn<sub>3</sub>P<sub>2</sub>-type tetragonal),  $\beta$ ZnP<sub>2</sub> (monoclinic), and  $\alpha$ ZnP<sub>2</sub> (tetragonal).

## Ternary Isothermal Section

With starting materials of 99.99% Fe, 99.5% P, and 99.99% Zn, [2008Li] melted 40 alloy compositions in evacuated quartz tubes. The samples were annealed at 450 °C for 60 d and quenched in water. The phase equilibria were studied with x-ray powder diffraction and a scanning

electron microscope equipped with energy dispersive spectroscopy. The isothermal section at 450 °C constructed by [2008Li] is redrawn in Fig. 1. As compared to the section at 750 °C, the Fe-Zn intermediate phases  $\Gamma_1$ ,  $\delta$ , and  $\zeta$  have appeared along the Fe-Zn side at 450 °C. The tie-triangles of (Fe<sub>2</sub>P + FeP + L) and (FeP +  $\alpha$ Zn<sub>3</sub>P<sub>2</sub> + L) seen in Fig. 1 are expected to result from a U-type transition reaction between 750 and 450 °C: Fe<sub>2</sub>P +  $\alpha$ Zn<sub>3</sub>P<sub>2</sub>  $\leftrightarrow$  FeP + L. The solubility of P in the binary compounds was found to be negligible [2008Li].

## References

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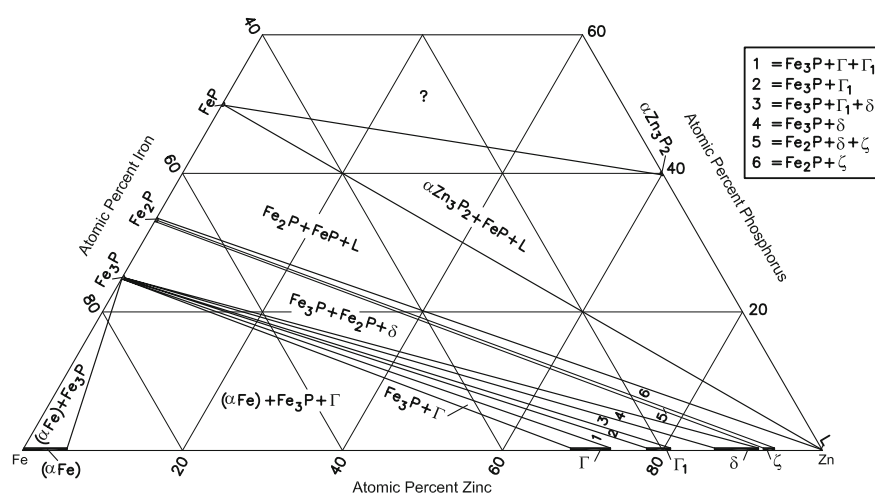


Fig. 1 Fe-P-Zn partial isothermal section at 450 °C [2008Li]