# Fe-Ti-Y (Iron-Titanium-Yttrium)

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The two previous investigations of this ternary system by [1994Zen] and [1997Liu] reported isothermal sections at 500 and 600 °C respectively. These results were reviewed by [2001Rag] and [2000Rag]. Recently, [2009Gon] reported experimental results on this system at 1000 °C and presented a thermodynamic analysis.

## Binary Systems

There are two intermediate phases in the Fe-Ti system: $Fe_2Ti$ (*C*14, $MgZn_2$-type hexagonal) and FeTi (*B*2, CsCl-type cubic). The Fe-Y system is characterized by the presence of four compounds: $Fe_2Y$ (*C*15, $MgCu_2$-type cubic), $Fe_3Y$ ($Be_3Nb$-type rhombohedral), $Fe_{23}Y_6$ ($Mn_{23}Th_6$-type cubic) and $Fe_{17}Y_2$ ($Ni_{17}Th_2$-type hexagonal or $Th_2Zn_{17}$-type rhombohedral). In the Ti-Y system, there

are no intermediate phases. The terminal solid solubility is negligible.

## Ternary Phase Equilibria

The study of [2009Gon] presents serious discrepancies. Quoting from their paper: "The experimental results show that $Fe_2Ti$ and $Fe_2Y$ form a continuous solid solution, namely, $Fe_2(Y,Ti)$". The previous results of [1994Zen] and [1997Liu] show little solubility between $Fe_2Ti$ and $Fe_2Y$. Moreover, they form different crystal structures. [2009Gon] modeled the "continuous solid solution" phase with two sub-lattices, with Ti and Y sharing sites in the second sublattice. They computed two isothermal sections at 600 and 1000 °C. In none of the above sections, a continuous solid solution is seen. At 1000 °C, a large liquid field is indicated at the Ti corner. Ti is solid at this temperature and shows little solubility for Y. In view of these serious anomalies, the results of [2009Gon] are not discussed further.

The isothermal section at 500 °C from the first investigation of this system by [1994Zen] (not presented in the earlier reviews) is redrawn in Fig.1.
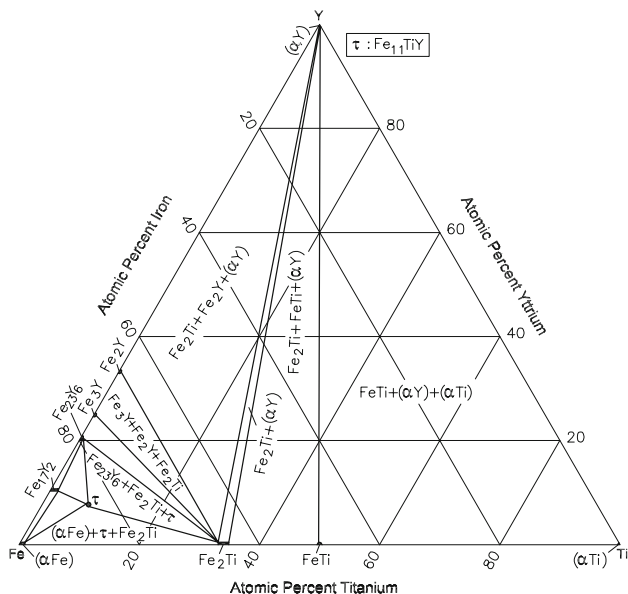


**Fig. 1** Fe-Ti-Y isothermal section at 500 °C [1994Zen]

## References

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**1997Liu:** Z. Liu, Z. Jin, and C. Xia, 873 K Isothermal Section of Phase Diagram for Y-Fe-Ti Ternary System, *Scr. Mater.*, 1997, **37**(8), p 1129-1134

**2000Rag:** V. Raghavan, Fe-Ti-Y (Iron-Titanium-Yttrium), *J. Phase Equilib.*, 2000, **21**(5), p 467

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**2009Gon:** W.P. Gong, T.F. Chen, D.J. Li, and Y. Liu, Thermodynamic Investigation of Fe-Ti-Y Ternary System, *Trans. Nonferrous Met. Soc. China*, 2009, **19**, p 199-204