

Fe-La-Ni (Iron-Lanthanum-Nickel)

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Recently, Zhou et al. [2002Zho] determined two partial isothermal sections for this system, one at 550 °C for Ni-rich alloys and the other at 400 °C for La-rich alloys.

Binary Systems

The Fe-La phase diagram [1993Oka] depicts no intermediate phases. The mutual solubility between Fe and La is negligible. The Fe-Ni phase diagram [1993Swa] is characterized by a very narrow solidification range, with a peritectic reaction at 1514 °C, between body-centered-cubic δ and liquid that yields the Fe-based face-centered-cubic (fcc) solid solution. A continuous solution denoted γ between fcc Fe and Ni is stable over a wide range of temperatures. At lower temperatures, an ordered phase FeNi₃ forms congruently at 517 °C from γ . The La-Ni phase diagram was updated by [2002Oka]. It depicts eight intermediate phases: La₃Ni, La₇Ni₃, LaNi, La₂Ni₃, La₇Ni₁₆, LaNi₃, La₂Ni₇ and LaNi₅. See [Pearson3] for structural data.

Ternary Isothermal Sections

With starting materials of purity of 99.99% Fe, 99.9% La, and 99.99% Ni, [2002Zho] melted 201 alloy compositions in an arc furnace under Ar atm. The Ni rich alloys

were given a final anneal at 550 °C for 7 d and the La rich alloys were annealed at 400 °C for 40 d. The phase equilibria were studied by x-ray diffraction and scanning electron microscopy. Their isothermal sections at 550 °C (for Ni-rich alloys) and at 400 °C for La-rich alloys are redrawn in Fig. 1 to agree with the accepted binary data. No ternary compounds were found. The binary compounds LaNi₅, La₂Ni₇, LaNi₃, La₇Ni₁₆, La₂Ni₃, and LaNi dissolve 10, 5, 4, 1.5, 3, and 2 at.% Fe, respectively. The compound La₃Ni was not found by [2002Zho]. In Fig. 1, the region near La₃Ni is left with a question mark.

References

- 1993Oka:** H. Okamoto: "Fe-La (Iron-Lanthanum)" in *Phase Diagrams of Binary Iron Alloys*, H. Okamoto, ed., ASM International, Materials Park, OH, 1993, pp. 192-93.
- 1993Swa:** L.J. Swartzendruber, V.P. Itkin, and C.B. Alcock: "Fe-Ni (Iron-Nickel)" in *Phase Diagrams of Binary Iron Alloys*, H. Okamoto, ed., ASM International, Materials Park, OH, 1993, pp. 256-78.
- 2002Oka:** H. Okamoto: "La-Ni (Lanthanum-Nickel)," *J. Phase Equilibria*, 2002, 23(3), pp. 287-88.
- 2002Zho:** H. Zhou, Y. Zhu, J. Liu, Y. Zhuang, and S. Yuan: "Isothermal Sections (400 and 550 °C) of the Phase Diagram of the La-Ni-Fe Ternary System," *J. Alloys Compd.*, 2002, 345, pp. 167-69.

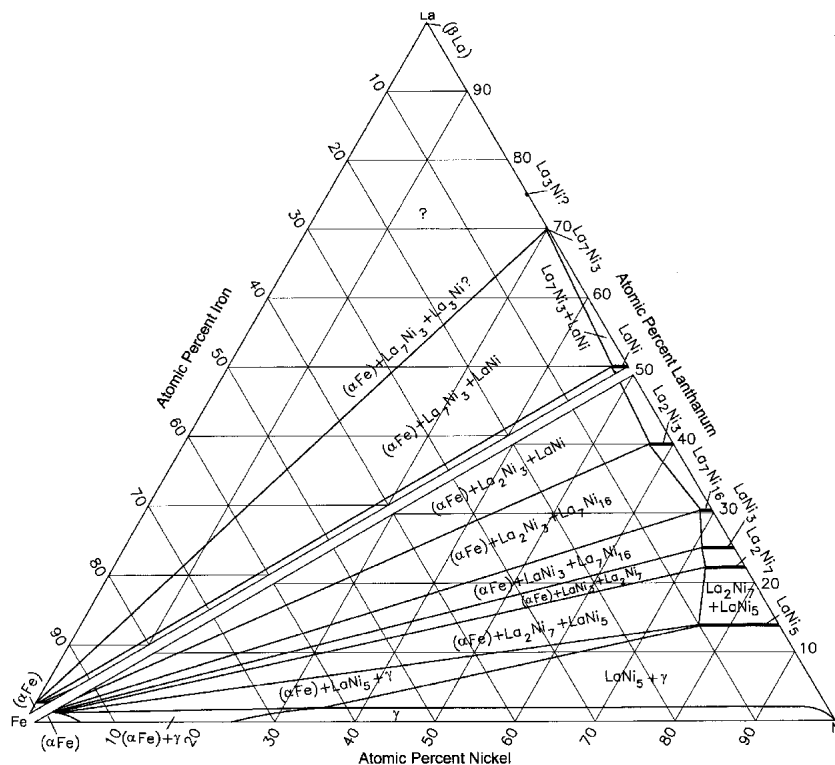


Fig. 1 Fe-La-Ni isothermal sections at 550 and 400 °C for Ni-rich alloys and La-rich alloys, respectively [2002Zho]; narrow two-phase regions around tie-triangles are not shown