

Al-La-Mg (Aluminum-Lanthanum-Magnesium)

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Among the previous reports on this system, [1981Zar] determined a partial isothermal section at 400 °C for La concentration up to 33.3 at.%. Subsequently, [1988Odi] determined a full isothermal section for this system at 400 °C.

Binary Systems

The Al-La phase diagram [2006Zho] depicts the following intermediate phases: La_3Al ($D0_{19}$, Ni_3Sn -type hexagonal), LaAl (CeAl-type orthorhombic), LaAl_2 (C15, MgCu_2 -type cubic), La_3Al_7 (stable between 1240 and 1091 °C; C32, AlB_2 -type hexagonal), LaAl_3 (Ni_3Sn -type hexagonal), $\beta\text{La}_3\text{Al}_{11}$ ($D1_3$, Al_4Ba -type tetragonal), and $\alpha\text{La}_3\text{Al}_{11}$ ($\alpha\text{La}_3\text{Al}_{11}$ -type orthorhombic). The Al-Mg phase diagram has the following intermediate phases: Mg_2Al_3 (cubic, labeled β), R or ϵ (rhombohedral), and $\text{Mg}_{17}\text{Al}_{12}$ ($A12$, αMn -type cubic, denoted γ). The La-Mg phase diagram [2004Guo] depicts the following intermediate phases: Mg_{12}La (Mg_{12}Ce -type orthorhombic), $\text{Mg}_{17}\text{La}_2$ ($\text{Ni}_{17}\text{Th}_2$ -type hexagonal), Mg_3La ($D0_3$, BiF_3 -type cubic), Mg_2La (C15, MgCu_2 -type cubic), and MgLa (B2, CsCl-type cubic).

Ternary Phase Equilibria

With starting metals of 99.995% Al, 99.95% Mg, and 98.48% La, [1988Odi] arc-melted 115 alloys and annealed them at 400 °C for 480 h. The phase equilibria were studied by metallography and x-ray powder diffraction. The isothermal section at 400 °C constructed by [1988Odi] is redrawn in Fig. 1 to comply with the accepted binary data. Mg_2La is not stable at 400 °C. It is possible that the phase based on Mg_2La (labeled λ here) is stable in the ternary region only. The phase relationships in this region shown in Fig. 1 are tentative. A ternary compound $\text{Al}_2\text{Mg}_{0.85}\text{La}_{0.15}$ (denoted τ here) of unknown structure is stable at this temperature [1988Odi].

References

1981Zar: O.S. Zarechnyuk, V.V. Kinzhbalo, A.T. Tyvanchuk, and R.M. Rykhal, X-ray Diffraction Study of the Mg-Al-La and Mg-Al-Nd Systems in the Range 0-33.3 at.% REM, *Metally*,

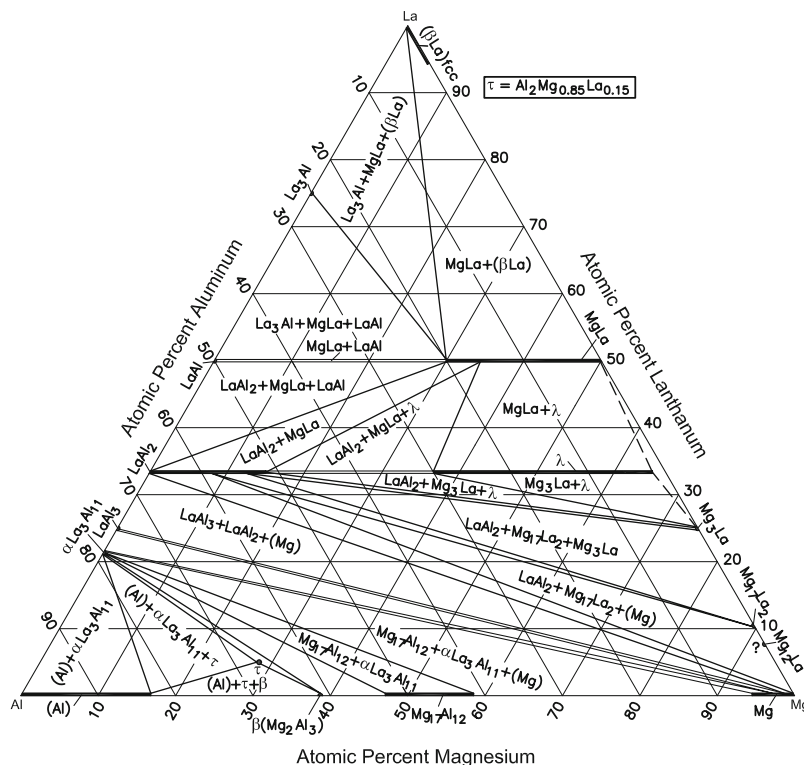


Fig. 1 Al-La-Mg isothermal section at 400 °C [1988Odi]. Narrow two-phase regions are omitted

- 1981, (5), p 221-223, in Russian; TR: *Russ. Metall.*, 1981, (5), p 173-175
- 1988Odi:** Kh.O. Odinaev, I.N. Ganiev, V.V. Kinzhbalo, and A.T. Tyvanchuk, Phase Diagram of the Al-Mg-La System at 400 °C, *Tsvetn. Metall.*, 1988, (2), p 81-85, in Russian
- 2004Guo:** C. Guo and Z. Du, Thermodynamic Assessment of the La-Mg System, *J. Alloys Compd.*, 2004, **385**, p 109-113
- 2006Zho:** S.H. Zhou and R.E. Napolitano, Phase Equilibria and Thermodynamic Limits for Partitionless Crystallization in the Al-La Binary System, *Acta Mater.*, 2006, **54**, p 831-840