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Ag-Al-Sm (Silver-Aluminum-Samarium)

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Zhak et al. [1996Zha] determined an isothermal section for this system at 597 °C (870 K), which depicts six ternary compounds.

Binary Systems

The Ag-Al phase diagram [Massalski2] depicts three intermediate phases: Ag_3Al (20.5-29.8 at.% Al; denoted β, body-centered cubic; stable between 778 and ~600 °C), Ag_2Al (22.9-41.9 at.% Al; denoted δ, close-packed hexagonal), and μ (21-24 at.% Al, stable below 450 °C; *A*13, βMn-type cubic). The Ag-Sm phase diagram [Massalski2] has the following intermediate phases: $Ag_{51}Sm_{14}$ ($Ag_{51}Gd_{14}$-type hexagonal), βAg_2Sm (Ag_3Pu-type hexagonal, deficient in Ag), αAg_2Sm, and AgSm (*B*2, CsCl-type cubic). The Al-Sm phase diagram [2007Del, Massalski2] depicts the following intermediate phases: Sm_3Al_{11} ($D1_3$, Al-deficient Al_4Ba-type tetragonal), $SmAl_3$ ($D0_{19}$, Ni_3Sn-type hexagonal), $SmAl_2$ (*C*15, $MgCu_2$-type cubic), SmAl (ErAl-type orthorhombic), and Sm_2Al (*C*23, Co_2Si-type orthorhombic).

Ternary Phases

The known ternary compounds of this system are listed in Table 1 from [1996Zha]. The compounds labeled τ_1 to τ_6 (denoted 1 to 6 by [1996Zha]) are present at 597 °C (870 K) [1996Zha]. The binary compound AgSm dissolves 5 at.% Al. The compounds Sm_3Al_{11} and $SmAl_2$ dissolve 17.4 and 26 at.% Ag [1996Zha].

Isothermal Section

With starting metals of 99.9% Ag, 99.99% Al, and 99.5% Sm, [1996Zha] arc-melted 110 alloy compositions in Ar atm. The samples containing up to 50 at.% Ag and 33.3 at.% Sm were annealed at 597 °C for 700 h and all others for 1500 h. After annealing, the samples were quenched in water. The phase equilibria were studied by x-ray powder diffraction. The isothermal section at 597 °C (870 K) constructed by [1996Zha] is redrawn in Fig. 1, to agree with the accepted binary data. The compositions of the ternary phases shown in Fig. 1 are from the listed values of [1996Zha]. According to [2007Del], the binary phase Sm_3Al_{11} is not stable below 1070 °C, but [1996Zha] found this phase at 597 °C. As [1996Zha] determined the αLa_3Al_{11}-type orthorhombic structure for this phase, it is possible that it is a ternary phase stabilized by small additions of Ag, as indicated tentatively in Fig. 1.

Table 1 Ag-Al-Sm crystal structure and lattice parameter data [1996Zha]

Phase	Composition, at.%	Pearson symbol	Space group	Prototype	Lattice parameter, nm
$Sm_{1.6}Ag_{9.4\text{-}6.5}Al_{7.6\text{-}10.5}$ (τ_1)	50.5-34.9 Ag 40.9-56.5 Al 8.6 Sm	*hP*38	$P6_3/mmc$	$Ni_{17}Th_2$	a = 0.9318 c = 0.9119
$Sm_2Ag_{11.4\text{-}9.5}Al_{5.6\text{-}7.5}$ (τ_2)	60-50 Ag 29.5-39.5 Al 10.5 Sm	*hR*19	$R\bar{3}m$	$Zn_{17}Th_2$	a = 0.9370 c = 1.3641
$SmAg_{2.0\text{-}2.6}Al_{3.0\text{-}2.4}$ (τ_3)	33.3-43.3 Ag 50-40 Al 16.7 Sm	…	$P6_3/mmc$	$DyAg_{2.4}Al_{2.6}$	a = 0.92272 c = 0.94821
~$SmAg_{3.7}Al_{1.1}$ (τ_4)	63.8 Ag 19 Al 17.2 Sm	hex.	…	…	a = 0.5407 c = 0.9253
$SmAg_{1.15}Al_{1.85}$ (τ_5)	28.75 Ag 46.25 Al 25 Sm	*hR*12	$R\bar{3}m$	$PuNi_3$	a = 0.55903 c = 2.6560
$SmAg_{1.7\text{-}1.4}Al_{0.3\text{-}0.6}$ (τ_6)	56.7-46.7 Ag 10-20 Al 33.3 Sm	*oI*12	*Imma*	$CeCu_2$	a = 0.46560 b = 0.7237 c = 0.7951

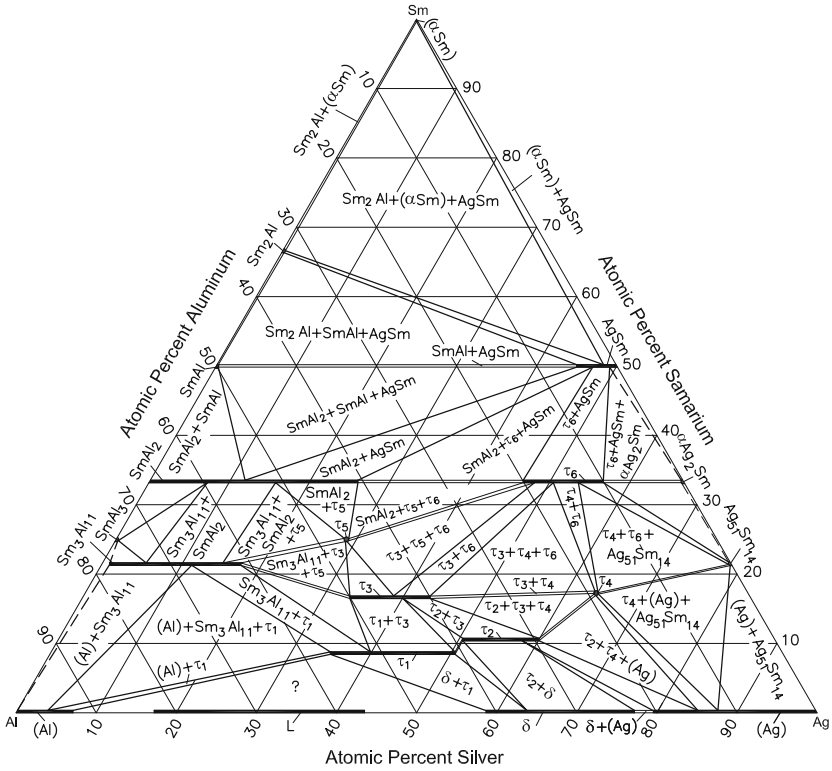

Fig. 1 Ag-Al-Sm isothermal section at 597 °C [1996Zha]

References

1996Zha: O.V. Zhak, B.M. Stelmakhovych, and Yu.B. Kuzma, The Sm-Ag-Al System, *J. Alloys Compd.*, 1996, **237**, p 144-149

2007Del: S. Delsante, R. Raggio, G. Borzone, and R. Ferro, A Revision of the Al-Rich Region of the Sm-Al Phase Diagram: The Sm_3Al_{11} Phase, *J. Phase Equilib. Diffus.*, 2007, **28**(3), p 240-242