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Ag-Al-Y (Silver-Aluminum-Yttrium)

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Recently, [2000Gum] determined an isothermal section for this system at 597 °C (870 K), which depicts eight 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-Y [Massalski2] diagram depicts the following intermediate phases: $Ag_{51}Y_{14}$ ($Ag_{51}Gd_{14}$-type hexagonal), Ag_2Y ($C11_b$, $MoSi_2$-type tetragonal), and AgY (*B*2, CsCl-type cubic). The Al-Y phase diagram [2006Liu] depicts the following intermediate phases: Y_2Al (*C*23, Co_2Si-type orthorhombic), Y_3Al_2 (Zr_3Al_2-type tetragonal), YAl (B_f, CrB-type orthorhombic), YAl_2 (*C*15, $MgCu_2$-type cubic), αYAl_3 ($D0_{19}$, Ni_3Sn-type hexagonal), βYAl_3 (stable between 980 and 645 °C, $BaPb_3$-type rhombohedral).

Ternary Phases

The known ternary compounds of this system are listed in Table 1 from [2000Gum] . The compounds denoted τ_1 to τ_8 (labeled 1 to 8 by [2000Gum]) are present at 597 °C (870 K). The last-listed compound ~$YAgAl_3$ was not found at 597 °C [2000Gum] . It may be noted that $YAgAl_3$ and $Y_3Ag_{1.5}Al_{9.5}$ (τ_6) are both derivatives of Al_4Ba-type of structure. Among the binary phases, AgY and YAl_2 dissolve 30 at.% Al and 7.3 at.% Ag, respectively.

Table 1 Ag-Al-Y crystal structure and lattice parameter data [2000Gum]

Phase	Composition, at.%	Pearson symbol	Space group	Prototype	Lattice parameter, nm
$YAg_{5.1\text{-}5.7}Al_{6.9\text{-}6.3}$ (τ_1)	39.2-43.8 Ag 53.1-48.5 Al 7.7 Y	*tI*26	*I*4/*mmm*	$ThMn_{12}$	*a* = 0.91303* *c* = 0.54646
$Y_{1.8}Ag_{7.9\text{-}8.5}Al_{9.1\text{-}8.5}$ (τ_2)	42.0-45.2 Ag 48.4-45.2 Al 9.6Y	*hP*38	$P6_3/mmc$	Th_2Ni_{17}	*a* = 0.92852* *c* = 0.90702
$Y_8Ag_{19.4}Al_{46.6}$ (τ_3)	26.2 Ag 63.0 Al 10.8 Y	*tI*?	*I*4/*mmm*	$Yb_8Cu_{17}Al_{49}$	*a* = 0.88278 *c* = 1.66993
$YAg_{2.3\text{-}2.6}Al_{2.7\text{-}2.4}$ (τ_4)	38.3-43.3 Ag 45-40 Al 16.7 Y	*hP*?	$P6_3/mmc$	$DyAg_{2.4}Al_{2.6}$	*a* = 0.91523* *c* = 0.94167
~$YAg_{3.8}Al_{1.2}$ (τ_5)	63.3 Ag 20 Al 16.7 Y	Hex.	…	…	*a* = 0.5362 *c* = 0.9198
$Y_3Ag_{1.5}Al_{9.5}$ (τ_6)	10.7 Ag 67.85 Al 21.4 Y	*oI*28	*Immm*	αLa_3Al_{11}	*a* = 0.42827 *b* = 1.26026 *c* = 1.00312
$Y_3Ag_2Al_7$ (τ_7)	16.7 Ag 58.3 Al 25 Y	*hR*12	$R\bar{3}m$	$Ca_3Cu_2Al_7$	*a* = 0.55422 *c* = 2.6259
$YAg_{0.6}Al_{1.4}$ (τ_8)	20 Ag 46.7 Al 33.3 Y	*oI*12	*Imma*	$CeCu_2$	*a* = 0.45399 *b* = 0.71551 *c* = 0.78712
$YAgAl_3$	20 Ag 60 Al 20 Y	*oI*?	*Immm*	$CeNi_2Sb_2$	*a* = 0.4295 *b* = 0.4184 *c* = 1.0039

* Latttice parameters are for $YAg_{5.2}Al_{6.8}$, $Y_{1.8}Ag_{8.3}Al_{8.7}$, and $YAg_{2.3}Al_{2.7}$, respectively

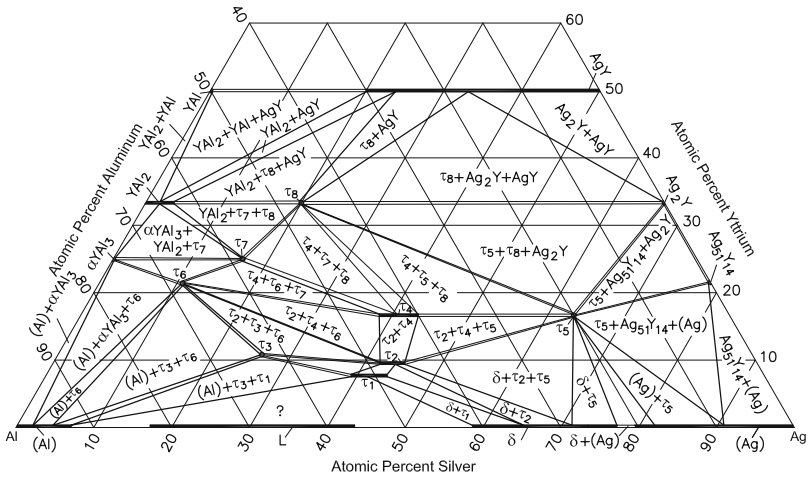

Fig. 1 Ag-Al-Y isothermal section at 597 °C (870 K) [2000Gum]

Isothermal Section

With starting metals of 99.95% Ag, 99.99% Al, and 99.5% Y, [2000Gum] arc-melted under Ar atm 69 alloys with Y content up to 50 at.%. The alloys were annealed at 597 °C (870 K) for ~1000 h and quenched in water. The phase equilibria were studied mainly with x-ray powder diffraction. The isothermal section at 597 °C 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 [2000Gum].

References

2000Gum: T.M. Gumenyuk, Yu.B. Kuzma, and B.M. Stelmakhovych, The Y-Ag-Al System, *J. Alloys Compd.*, 2000, **299**, p 213-216

2006Liu: S. Liu, Y. Du, H. Xu, C. He, and J.C. Schuster, Experimental Investigation of the Al-Y Phase Diagram, *J. Alloys Compd.*, 2006, **414**, p 60-65