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Ag-Al-Dy (Silver-Aluminum-Dysprosium)

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[1994Ste] 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-Dy phase diagram [Massalski2] depicts the following intermediate phases: $Ag_{51}Dy_{14}$ ($Ag_{51}Gd_{14}$-type hexagonal), Ag_2Dy ($C11_b$, $MoSi_2$-type tetragonal), and AgDy (CsCl-type cubic). The Al-Dy [2000Oka, Massalski2] phase diagram shows the following intermediate phases: Dy_2Al (*C*23, Co_2Si-type orthorhombic), Dy_3Al_2 (Zr_3Al_2-type tetragonal), DyAl (ErAl-type orthorhombic), $DyAl_2$ (*C*15, $MgCu_2$-type cubic), α$DyAl_3$ ($D0_{24}$, Ni_3Ti-type hexagonal), β$DyAl_3$ (stable between 1090 and 1005 °C; $HoAl_3$-type rhombohedral).

Ternary Phases

The known ternary compounds of this system are listed in Table 1 from [1994Ste]. The compounds denoted τ_1 to τ_6 (labeled 1-6 by [1994Ste]) are present at 597 °C (870 K). Among the binary phases, AgDy and $DyAl_2$ dissolve 21 at.% Al and 11.7 at.% Ag respectively.

Isothermal Section

With starting metals of 99.9% Ag, 99.99% Al, and 99.5% Dy, [1994Ste] arc-melted under Ar atm alloys with Dy content up to 50 at.%. The alloys were annealed at 597 °C (870 K) for 1200 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. A liquid phase present along the Al-Ag side was omitted by [1994Ste]. The compositions of the ternary phases shown in Fig. 1 are from the listed values of [1994Ste].

Table 1 Ag-Al-Dy crystal structure and lattice parameter data [1994Ste]

Phase	Composition, at.%	Pearson symbol	Space group	Prototype	Lattice parameter, nm
$Dy(Ag_{0.52-0.46}Al_{0.48-0.54})_{12}$ (τ_1)	48-42.5 Ag 44.3-49.8 Al 7.7 Dy	*tI*26	*I*4/*mmm*	$ThMn_{12}$	*a* = 0.9134* *c* = 0.5446
$Dy_2(Ag_{0.47-0.53}Al_{0.53-0.47})_{17}$ (τ_2)	42.1-47.4 Ag 47.4-42.1 Al 10.5 Dy	*hP*38	$P6_3/mmc$	Th_2Ni_{17}	*a* = 0.9285* *c* = 0.9092
$Dy_4(Ag_{0.26}Al_{0.74})_{33}$ (τ_3)	23.2 Ag 66 Al 10.8 Dy	*tI*?	*I*4/*mmm*	$Yb_8Cu_{17}Al_{49}$	*a* = 0.8793 *c* = 1.6800
$Dy(Ag_{0.47-0.58}Al_{0.53-0.42})_5$ (τ_4)	39.2-48.3 Ag 44.2-35 Al 16.7 Dy	*hP*?	$P6_3/mmc$	$DyAg_{2.4}Al_{2.6}$	*a* = 0.9132* *c* = 0.9410
$Dy(Al_{0.14}Al_{0.86})_4$ (τ_5)	11.2 Ag 68.8 Al 20 Dy	*oI*?	*Immm*	*o*-$CeNi_2Sb_2$	*a* = 0.4296 *b* = 0.4179 *c* = 0.9995
$Dy(Ag_{0.71}Al_{0.29})_2$ (τ_6)	47.3 Ag 19.3 Al 33.3 Dy	*oI*12	*Imma*	$CeCu_2$	*a* = 0.4549 *b* = 0.7113 *c* = 0.7871

* Lattice parameters are for $DyAg_{5.6}Al_{6.4}$, $Dy_{1.75}Ag_{8.4}Al_{9.2}$, and $DyAg_{2.4}Al_{2.6}$, respectively

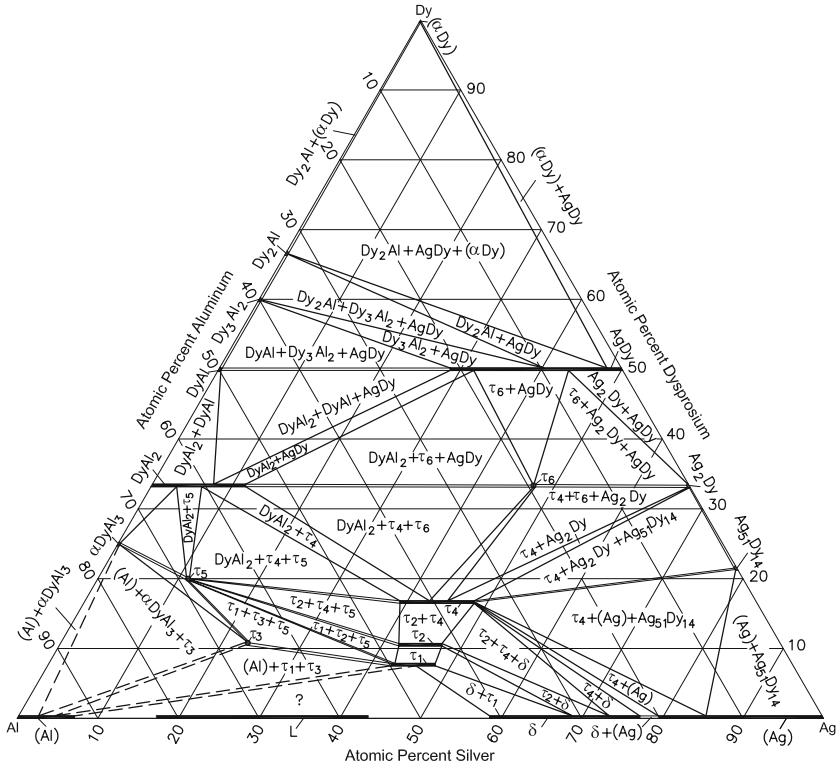

Fig. 1 Ag-Al-Dy isothermal section at 597 °C (870 K) [1994Ste]

References

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