SILVER

Ag^0

4d	5s	5p	5d	EN
↓↑ ↓↑ ↓↑ ↓↑ ↓↑	↓			1.4

1+ (d^{10}) **2+ (d^9) or "2+"** **3+ (d^8)** **"4+"** **5+ (d^6)**

Ag, met., wh., ductile, with high thermal and electrical conduct., $d = 10.5$, m.p. 962, b.p. 2210, sol. in ac.-Ox., (KCN + O_2), $E_0 Ag^+/Ag_{sol.} = 0.80$; cub. cl. pack., $a = 4.08$, Ag — Ag 2.88
Coll. Ag, grn. or blk. leaves with met. lustre ("collargol"), powd. yel.-brn. ("protargol"), have sterilizing effect.

Alloys
90% Ag + 10% Cu – silver-, 90% Au + 10% Ag – gold, monetary alloys
Amalgams, is easily formed, contains Ag_4Hg_3, Ag_5Hg_8 (m.p. 276 and 127). In system Ag–Zn–Pb – delamination, Ag sol. in Zn-layer (over)

$-Zn$ (1250°)

"Rough Pb"

Zn (t)

O_2 ($-SO_2$; baking)

Ag_3O, [19] conduct., in str. – oct. $[Ag_6]$

Ag_2O, brn., dec. 300, $\Delta H = -29$, SP $= 10^{-8}$, sol. in ac., NH_4OH, KCN; $+ H_2O \rightleftarrows Ag^+ + OH^-$ (pH > 7), $K = 10^{-4}$; cub., isostr. to Cu_2O (CN Ag 2, sp)

$H_2NC_2H_4OH$ (pH 9) [12]

AgOH

$-H_2O$ ($> -50°$)

O_2 (200°) (> 300°)

HX Hal$_2$

an. Ox. (OH$^-$) $K_2S_2O_8$ (90°); O_3 (OH$^-$)

MOH (conc.) Ag M_2O_2; M_2O

AgClO$_4$, colrl., dec. 486, readily sol. in H_2O, org. solv.
AgClO$_3$, colrl., m.p. 230, dec. 270; $+ H^+ \longrightarrow AgCl\downarrow + O_2$
AgBrO$_3$, poorly sol. in H_2O, stab. in $H^+ > AgClO_3$
AgIO$_3\downarrow$, SP $= 10^{-10}$, insol. in ac. (t)
Ag$_2$H$_3$IO$_6\downarrow$, yel.; **Ag$_5$IO$_6\downarrow$**, blk.

Ag$_2$SO$_4\downarrow$, cr., colrl., m.p. 660; $\xrightarrow{1000°} Ag + SO_2 + O_2$; SP $= 10^{-4}$, in str. CN Ag 6; $+ H_2SO_4 \longrightarrow AgHSO_4$
Ag$_2$S$_2$O$_3\downarrow$, wh., $+ H_2O \longrightarrow Ag_2S\downarrow + H_2SO_4$
Ag$_2$CrO$_4\downarrow$, red-brn.; **Ag$_2$Cr$_2$O$_7\downarrow$**, dark-red
AgNO$_3\downarrow$, cr., colrl., m.p. 212, dec. 444, sol. in H_2O, alc., Py, MeCN, liq. NH_3, coagulated protein
AgNO$_2\downarrow$, [= AgONO + Ag—NO$_2$], light yel., dec. 140, SP $= 10^{-3}$; $\cdot NH_3 = [Ag(NH_3)_2]^+[Ag(NO_2)_2]^-$
AgPO$_3\downarrow$, colrl., m.p. 482, sol. in dil. ac.
Ag$_4$P$_2$O$_7\downarrow$, colrl., m.p. 585
Ag$_3$PO$_4\downarrow$, yel., m.p. 849, SP $= 10^{-19}$
Ag$_3$AsO$_4\downarrow$, red; **Ag$_3$AsO$_3\downarrow$**, yel.
Ag$_2$CO$_3\downarrow$, light yel., dec. 100; SP $= 10^{-12}$, in str. – tetrah. $[AgO_4]$
AgCH$_3$COO, sol. in H_2O ~1%, $K_{dis} = 0.2$ [21]
Ag[BF$_4$]; **Ag[ƎF$_6$]**, E = P, As, Sb, Nb, Ta
Ag$_3$BO$_3$, in str. – chains of dumb-bells $[AgO_2]$ [22]
Ag[EH$_4$], E = B (wh.), Al (yel.), Ga (orange), dec. -30, -50, -75; $\cdot n$ PR$_3$, stab. $> 100°$
[Ag$_3$Hal](NO$_3$)$_2$, Hal = Cl–I, CN, SCN [11]

Ag$_2$F $= Ag_2^+ F^- e^-$, cr., bronze-grn., $\Delta H = -50$, conduct., stab. to hv-vis. $+ H_2O \xrightarrow{t} Ag + AgF$; anti-CdI$_2$ str. type, Ag—F 2.46, Ag—Ag 2.86

hv ($-F_2$)

	m.p.	b.p.	ΔH	SP	Solv.
AgF, colrl., stab. to hv-vis $\cdot n$ H$_2$O, $n = 1, 2, 4$, $\cdot n$ HF, $n = 1, 3$	435	—	-201	—	H$_2$O ≈ 65%
AgCl↓, colrl., "chlorargyrite" (melt. – orange), $\cdot n$ NH$_3$, $n = 1-3$	457	1554	-127	10^{-10}	NH$_4$OH, KCN, M$_2$S$_2$O$_3$
AgBr↓, wh. or yel.-grn. "bromargyrite"	434	700	-99	10^{-13}	NH$_4$OH, M$_2$S$_2$O$_3$, $K_{dis} = 10^{-4}$
AgI↓, light yel. "iodargyrite"	560 dec.	—	-62	10^{-16}	KCN, M$_2$S$_2$O$_3$, NH$_4$OH

Stab. to hv-vis AgBr > AgCl > AgI. Str. AgHal (Hal = F–Br) NaCl type (CN Ag 6), AgI – sphalerite or wurtzite types. [10]

AgNO$_3$ conc. s.

H_2S NH_3

Ag$_2$S↓, blk., m.p. 827, sol. in HNO$_3$ (t), KCN; SP $= 10^{-50}$, in Ag–Pb ores [18]
AgCN↓, wh., stab. to hv-vis, SP $= 10^{-14}$, in str. – linear chains
AgSCN↓, wh., SP $= 10^{-12}$
Ag$_3$N↓, nitride, exp., brn., $\Delta H = +225$, SP $= 10^{-9}$ [20]
AgN$_3$↓, azide, m.p. 252, exp. 300°, —Ag—N=N$^+$=N$^-$ [20]
AgONC, fulminate, exp., detonator; **AgOCN**, cyanat
CuAg$_3$S$_2$, "jalpaite"; **Ag$_8$GeS$_6$**, "argirodite"

an. Ox. (Pt) MNO$_2$ K_2CO_3

Argentates [7]
K[Ag(OH)$_2$], ex. in s. pH $\gg 7$
M$_4$[Ag$_4$O$_4$], M = Li–Cs, yel., anion – square
M$_3$[AgO$_2$], dumb-bell (sp),
Na$_4$Ag$_2$O$_3$; **Na$_2$Ag$_4$O$_3$**
MAg$_3$O$_2$; $+ H_2O \rightarrow Ag + O_2 + ...$

Na$_3$[Ag(S$_2$O$_3$)$_2$], $K_{stab} = 10^{14}$
K[Ag(NO$_2$)$_2$], $K_{stab} = 10^3$
Cs$_3$Ba[Ag(NO$_2$)$_6$] · 2 H$_2$O
K[Ag(CO$_3$)], in str. – chain of tetrah. $[AgO_4]$

+Py

Ag(SO$_3$F)$_2$, dec. 210; $+ H_2O \longrightarrow O_2 + ...$, **[AgPy$_4$]X$_2$**, X = NO$_3$, S$_2O_8$/2, orange., v. strong Ox., cation – square $[AgN_4]$ [14]
Ag$_3$(PO$_4$)$_2$, AgCrO$_4$

F$_2$; ClF$_3$

M^{II}AgF$_3$, [1]
M[AgCl$_2$], anion – tetrah., $K_{stab} = 10^6$
M[AgBr$_2$], $K_{stab} = 10^6$
MAgI$_2$, M$_2$AgI$_3$, in str. – chain of tetrah.
KAg$_2$I$_4$ · 8 H$_2$O;
[R$_4$N]$_2$Ag$_{13}$I$_{15}$, RbAg$_4$I$_5$ ionic conduct., in str. – channels from tetrah. [I$_4$]; Ag$^+$ can migrate along the channels
(PyH)$_5$Ag$_{18}$I$_{23}$
[AgHal$_2$]$^-$, $K_{stab} = 10^5$ (Cl), $8 \cdot 10^7$ (Br), 10^{12} (I)

F$_2$; ClF$_3$

AgF$_2$, cr., colrl., m.p. 690, $\Delta H = -347$, paramagn. ($< -110°$), ferromagn., strongest F-agent; $+ H_2O \longrightarrow Ag_2O + O_3 + HF$, in str. – squares $[AgF_4]$
Ag[M^{IV}F$_6$], M^{IV} = Ge–Pb, Ti–Hf, Rh, Pt, Pd, stab. $< 600°$, $\mu_{eff} = 2.0$ [3, 4]

F$_2$

Ag$_2$SO$_4$ + M^{II}CO$_3$

MF + F$_2$

MAgF$_3$, M = K–Cs
M$_2$AgF$_4$, M = K–Cs, Ca–Ba/2, Cd/2, Hg/2, anion – square [5]
Ba$_2$AgF$_6$

AgF$_3\downarrow$, [6] red-brn., diamagn., $200° \rightarrow AgF_2 + F_2$

M[AgF$_4$], M = K–Cs, [O$_2$], yel., v. hyg., diamgn., anion – square, **Ba[AgF$_5$]** [6]

CsF + F$_2$ (p)

AgF

MAgO

AgO↓ $= Ag^I Ag^{III}O_2$, blk., cub., dec. 100 (α), 178 (β); $\Delta H = -13$, sol. in HNO$_3$, HClO$_4$; $+ H_2SO_4 \longrightarrow Ag_2SO_4 + O_2\uparrow$; v. Ox., semiconduct., diamagn., in str. α-form dumb-bells $[Ag^IO_2]$ and squares $[Ag^{III}O_4]$, in str. β-form – tetrah. $[Ag^{I,III}O_4]$ [8,17]

Ag$_3$O$_4$ $= Ag_2^{III}Ag^{II}O_4$, blk. [17]

20°

H_2O (t) HX (dil.)

Ag$_7$O$_8$X, X = HF$_2$, ClO$_4$, HSO$_4$, NO$_3$, blk., with met. lustre, conduct. [2] $+ H_2O \xrightarrow{t} AgO\downarrow + O_2 + AgNO_3$, in str. – cubes $[AgIO_8]$ and squares $[Ag^{III}O_4]$

Ag$_2$O$_3$, blk., dec. -20, isostr. to Au_2O_3 [13, 17]

O_3 (H$^+$); an. Ox.

Ag

M$_5$[Ag(HIO$_6$)$_2$] · n H$_2$O
Na$_5$[Ag(H$_2$TeO$_6$)$_2$] · 12.5 H$_2$O
light yel., diamagn. (d^8), anion – square (dsp^2) [15]

KIO$_4$ + KOH (an. Ox.; $K_2S_2O_8$)

Ag

Cs$_2$[AgF$_6$], K$_2$PtCl$_6$ str. type, oct. $[Ag^{III}F_6]$, $d^8(t_{2g}^6 e_g^2)$ and $[Ag^VF_6]$ [16]

Ag

1+
Ag$^+$, colrl., stab. to hydr., antibakterial

An. Ox. H$_2$O ($-O_2$)

2+
Ag^{2+} (?), brn. s., v. strong Ox.

H$^+$ OH$^-$ pH > 7

HNO$_3$; H$_2$SO$_4$ $C_{12}H_{22}O_{11}$; [HI]

0
Ag↓, coll. s.

O_2 + KCN Zn

Ag

M[Ag(CN)$_2$], linear ion, $K_{stab} = 10^{21}$
M$_n$[Ag(SCN)$_{n+1}$], $n = 1 - 5$, $K_{stab} = 10^8$ [9, 18]

[Ag(OH)$_2$]$^-$, colrl. linear, $K_{stab} = 10^4$, strong bas.
[Ag(NH$_3$)$_2$]$^+$, linear, $K_{stab} = 10^7$

[AgAm$_4$]$^{2+}$, square
[AgAm$_6$]$^{2+}$, oct., brn. or orange, paramagn. (d^9), v. strong Ox.

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