GOLD

$1+(d^{10})$ "2+" $3+(d^{8})$ $5+(d^{6})$ $7+(d^{4})$

Au⁰ 5d ↓↑ ↓↑ ↓↑ ↓↑ ↓↑; 6s ↓; 6p; 6d — EN 1.4

AuO = $Au^{I}[Au^{III}O_2]$, powd., grn.

Au_2O_3, powd., brn., $\Delta H = -3$, net of squares [5]

> 260°; H_2; CO (100°)

100°

AuO(OH)

$-H_2O(P_2O_5)$

$Au_2O_3 \cdot 2H_2O$↓, "auric ac.", yel.-brn., sol. in ac., alk., $K_{ac} = 10^{-12}$ (I), 10^{-14} (II), 10^{-16} (III) $> K_{bas.}$

$Au_2O \cdot x H_2O$↓, dark-vlt.; + MOH ⟶ bl. sol.

MOH

Aurates (I), **Cs[AuO]**, in str. – anions $[Au_4O_4]^{4-}$ **Na_3AuO_2**, [6]

Au, met. yel., $d = 19.32$, m. p. 1064.4; b. p. 2947, volat. > 1000°, does not react. with O_2, N_2, C, S; sol. in aq. regia, (Cl_2 + HCl), (H_2SO_4 + HNO_3), (H_2SO_4 + $HMnO_4$), H_2SeO_4 (*t*), (KCN + O_2); $E_0 Au^+/Au_{sld.} = 1.68$, $E_0 Au^{3+}/Au_{sld.} = 1.50$ Cub. cl. pack. (Cu str. type), $a = 4.08$, Au — Au 2.88

electrolytic – refining in s. $HAuCl_4$

$Zn[-M_2Zn(CN)_4]$ — K[Au(CN)₄]

$NaNO_3$ (– NO)

H_2O

Aurates (III), **$K[Au(OH)_4] \cdot H_2O$**, yel. **$M^{II}[Au(OH)_4]_2$**, M = Ca – Ba (**$\cdot 5H_2O$**, grn.), anion – square (dsp^2) **$NaAuO_2$**, **$M_6[Au_2O_6]$**, anion – 2 squares sharing a edge [12]

$M_3[Au(S_2O_3)_2] \cdot H_2O$, colrl., anion – linear [S – Au – S] [9]

$[Au(SO_3F)_3]_2$, **$Au_2(SeO_4)_3$**, yel. **$Au(TeOF_5)_3$** [14]

$Na_5[Au(HIO_6)_2] \cdot 3.5H_2O$ [13]
$M[Au(SO_3F)_4]$;
$M[Au(SO_4)_2]$, yel.; **$K_5[Au(SO_3)_4]$**, colrl.
$M[Au(NO_3)_4]$, yel.
$H[Au(NO_3)_4] \cdot 3H_2O$, yel.
$K_2H[Au(NO_3)_6]$, **$M[Au(CH_3COO)_4]$**, anion – square

Cl_2(350°); Br_2 (70°); I_2 (50 – 100°)

H_2SeO_4; HSO_3F; an. Ox

F_2(350°); Cl_2 (200°); Br_2 (20°)

AuOCl↓, red, sol. in conc. HCl; $\xrightarrow{290°}$ Au + Cl_2 + O_2; [8]

electro-dispergating

"Coll. gold" (negativ), is formed in v. dil. s., with increasing particle size color changes as follows: red ("Cassius purple"), bl., vlt., blk.

Alloys
Amalgam contain **$AuHg_2$**, **$AuHg_3$**, **Au_3Hg** (m. p. 124, 310, 421)
In the system Cu — Au - continuous series of sld. s., < 400° in sld. phase form **$Cu_3Au_{1\pm n}$** and **$CuAu_{1\pm n}$** ("superstr.")

[1,17]

	ΔH
AuF, ex. only in gas	—
AuCl↓, cr., light yel., unstab.	–33
AuBr↓, cr., yel.	–18
AuI↓, cr., light-yel.	+1

In str. – chains Au–Hal–Au

AuHal $\xrightarrow{t}$ Au + Hal_2;
+ H_2O $\xrightarrow{t, h\nu(vis)}$ Au + $[AuHal_4]^-$
stab. AuI > AuCl;
· **$n NH_3$** (n = 1 – 12);
· **$n PH_3$** (n = 1, 2); · **CO**; · **PR_3**
AuCl(CO), mol. dumb-bell

M[$AuCl_2$], $K_{stab.} = 10^9$, **M[$AuBr_2$]**, $K_{stab.} = 10^{13}$ **M[AuI_2]**, anions diamagn., linear (*sp*), + H_2O ⟶ ⟶ Au + $[AuHal_4]^-$

$AuCl_2$, red, diamagn., $[Au^{III}_2Au^{I}_2Cl_4]^0$, $[Au^{III}Cl_2Cl_{2/2}]^0$, $[Au^{I}Cl_{2/2}]^0$ – chair, square, dumb-bell [16]

$M_2Au_2Hal_6$, in str. – dumb-bell $[Au^{I}Hal_2]^-$ and squares $[Au^{III}Hal_4]^-$ [16]

	dec.	ΔH
AuF_3, orange	500	–348
$AuCl_3$, red., m. p. 288 (*p*)	150	–117
$AuBr_3$, brn.	100	–54
AuI_3↓, grn.	20	—

$AuHal_3$ $\xrightarrow{t}$ AuHal + Hal_2.
In str. AuF_3 – spirals from squares. In str. and gas – Au_2Hal_6 (Hal = Cl – I) – flat dimeres [7,8]

M[AuF_4]$_n$, light-yel., anion – elong. oct.
$MAuCl_4$, M = Na ("Au-salt"), K (· H_2O), Cs↓, yel., diamagn.
$HAuCl_4 \cdot 4H_2O$, "Au-chloride", light-yel., hyg., needles, $K_{stab.} = 10^{22}$
$\xrightarrow{120°}$ $AuCl_3$ + H_2O + HCl
$KAuBr_4 \cdot 2H_2O$, purp., anion – square, $K_{stab.} = 10^{31}$
K_3AuBr_6, yel., anion – dist. oct.
$KAuI_4$, blk., strong Ox.
$HAuI_4$, unstab. [2]

AuF_5, red-brn., m. p. 75, diamagn., $\Delta H = -473$, in str. – cycle $[AuF_5]_4$, in gas $[AuF_5]_2$ [3]

[F] → **AuF_7**, cr. yel., volat.
100° ← ↓ H_2O → Au_2O_3 + Au [4]

60°

M[AuF_6]$_n$, yel., diamagn., anion – oct. (d^2sp^3) [3]

Cl_2 + HCl

KrF_2

KrF_2 + MF (liq. HF)

Br_2 + KBr + H_2O

KCN + O_2 + H_2O ("cyanidation")

H[Au(CN)$_4$]·3H_2O, sol. in alc., Et_2O
K[Au(CN)$_4$], $\xleftarrow{200°}$ · **H_2O**, colrl., anion – square, $K_{stab.} = 10^{56}$
K[Au(SCN)$_4$], orange, $K_{stab.} = 10^{42}$

Hal_2 + CN^-

AuCN↓, yel., isostr. to AgCN
AuSCN↓, dec. 140;
+ H_2O ⟶ $Au(SCN)_3$ + H_2

HCl

M[$Au(CN)_2$], colrl., anion – linear, $K_{stab.} = 10^{39}$ **M[$Au(SCN)_2$]**, $K_{stab.} = 10^{23}$

$Au(CN)_3 \cdot 3H_2O$↓, colrl.
$Au(SCN)_3$↓, red, v. unstab.

$NaAuS_2 \cdot 4H_2O$, colrl., dec. 30

$1-(s^2)$ **$0\ (d^{10}s^1)$**
M^+Au^-, M = K – Cs
M_3OAu [19]

Au_2S↓, grey or brn. powd., sol. in aq. regia; $\xrightarrow{240°}$ Au + S
Au_2S_2↓, blk.-brn.
Au_3N, nitride, exp.; · **NH_3**
AuN_3, azide, colrl., sol. in H_2O, $\Delta H = +280$, exp. even in s.
Au_2C_2, yel., exp. [18]
$[Au(NH_3)_2]^+$, colrl., linear cation, $K_{stab.} = 10^{27}$
$[Au(H_2O)_2]^+$

$M_3[AuS_2]$, colrl., anion dumb-bell
MAuS [10]

K[$Au(C \equiv CH)_2$]

Au_2S_3, blk., hydr.; $\xrightarrow{200°}$ Au + S

$[Au_2O_3 \cdot x NH_3 + Au(NH_2)_nX_m(NH)_p]$↓, "fulminic gold", yel.-brn., exp., sol. in KCN

$[Au(NH_3)_4]X_3$↓, X = NO_3, $CrO_4/2$, insol. in conc. ac.

$[Au(NH_3)_4]^{3+}$, colrl. ion, $K_{stab.} = 10^{30}$

H_2S gas (⩽ 10°)

NH_4NO_3 (surp.) + NH_3

NH_4Cl (surp.) + NH_3

HAuCl₄

$[Au_4L_4(\mu\text{-}I_2)]$; **$[Au_6L_8]X_2$**;
Au_5L_4Cl = $[Au^{I}(Au^{0}L)_4]^+Cl^-$;
$[Au_8L_7]X_2$ = $[Au^{I}(Au^{0}L)_7]X_2$;
$[Au_9L_8]X_3$; **$[Au_{11}L_7X_3]$**;
L = PR_3; clusters – $[Au_n]$, n = 4 (tetrah.), 6 (oct.), etc. [11]

$[Au(NH_3)_4]^{3+}$

Au

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