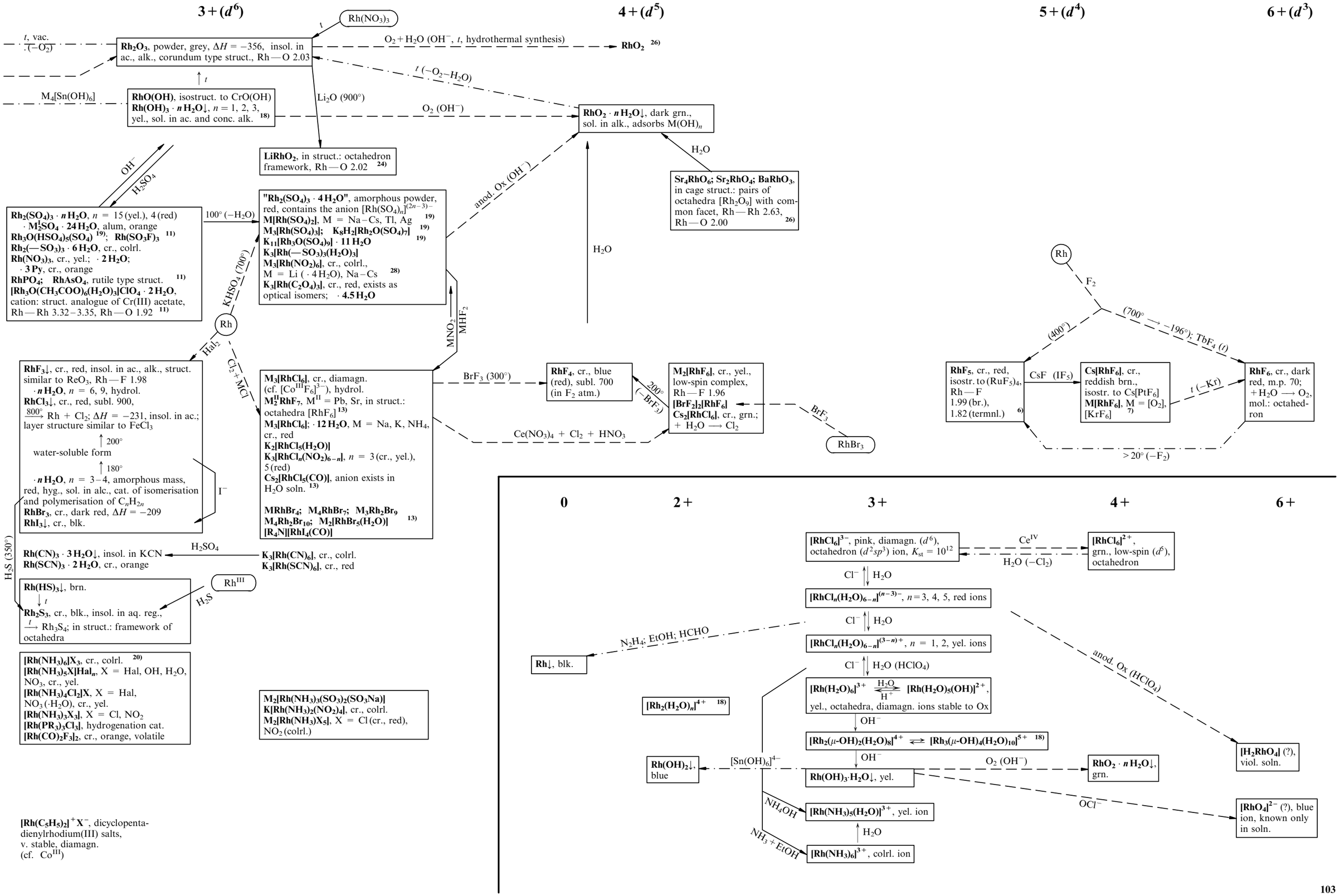
3 + (d6)
4 + (d5)
5 + (d4)
6 + (d3)
Rh(NO3)3
t, vac. (−O2)
Rh2O3, powder, grey, ΔH = −356, insol. in ac., alk., corundum type struct., Rh—O 2.03
O2 + H2O (OH−, t, hydrothermal synthesis)
RhO2 26)
t (−O2−H2O)
M4[Sn(OH)6]
RhO(OH), isostruct. to CrO(OH)
Rh(OH)3 · n H2O↓, n = 1, 2, 3, yel., sol. in ac. and conc. alk. 18)
Li2O (900°)
O2 (OH−)
RhO2 · n H2O↓, dark grn., sol. in alk., adsorbs M(OH)n
H2O
LiRhO2, in struct.: octahedron framework, Rh—O 2.02 24)
Sr4RhO6; Sr2RhO4; BaRhO3, in cage struct.: pairs of octahedra [Rh2O9] with common facet, Rh—Rh 2.63, Rh—O 2.00 26)
OH−
H2SO4
anod. Ox (OH−)
Rh2(SO4)3 · n H2O, n = 15 (yel.), 4 (red) · M2ISO4 · 24 H2O, alum, orange
Rh3O(HSO4)5(SO4) 19); Rh(SO3F)3 11)
Rh2(—SO3)3 · 6 H2O, cr., colrl.
Rh(NO3)3, cr., yel.; · 2 H2O; · 3 Py, cr., orange
RhPO4; RhAsO4, rutile type struct. 11)
[Rh3O(CH3COO)6(H2O)3]ClO4 · 2 H2O, cation: struct. analogue of Cr(III) acetate, Rh—Rh 3.32–3.35, Rh—O 1.92 11)
100° (−H2O)
"Rh2(SO4)3 · 4 H2O", amorphous powder, red, contains the anion [Rh(SO4)n]^(2n−3)− 19)
M[Rh(SO4)2], M = Na–Cs, Tl, Ag 19)
M3[Rh(SO4)3]; K8H2[Rh2O(SO4)7] 19)
K11[Rh3O(SO4)9] · 11 H2O
K3[Rh(—SO3)3(H2O)3]
M3[Rh(NO2)6], cr., colrl., M = Li (· 4 H2O), Na–Cs 28)
K3[Rh(C2O4)3], cr., red, exists as optical isomers; · 4.5 H2O
KHSO4 (700°)
Rh
MNO2
MHF2
H2O
Hal2
Cl2 + MCl
RhF3↓, cr., red, insol. in ac., alk., struct. similar to ReO3, Rh—F 1.98
· n H2O, n = 6, 9, hydrol.
RhCl3↓, cr., red, subl. 900, 800° → Rh + Cl2; ΔH = −231, insol. in ac.; layer structure similar to FeCl3
200°
water-soluble form
180°
· n H2O, n = 3–4, amorphous mass, red, hyg., sol. in alc., cat. of isomerisation and polymerisation of CnH2n
RhBr3, cr., dark red, ΔH = −209
RhI3↓, cr., blk.
I−
M3[RhCl6], cr., diamagn. (cf. [CoIIIF6]3−), hydrol.
M2IIRhF7, MII = Pb, Sr, in struct.: octahedra [RhF6] 13)
M3[RhCl6]; · 12 H2O, M = Na, K, NH4, cr., red
K2[RhCl5(H2O)]
K3[RhCln(NO2)6−n], n = 3 (cr., yel.), 5 (red)
Cs2[RhCl5(CO)], anion exists in H2O soln. 13)
MRhBr4; M4RhBr7; M3Rh2Br9
M4Rh2Br10; M2[RhBr5(H2O)] 13)
[R4N][RhI4(CO)]
BrF3 (300°)
RhF4, cr., blue (red), subl. 700 (in F2 atm.)
200° (−BrF3)
M2[RhF6], cr., yel., low-spin complex, Rh—F 1.96
[BrF2]2[RhF6]
Cs2[RhCl6], cr., grn.; + H2O → Cl2
BrF3
RhBr3
Ce(NO3)4 + Cl2 + HNO3
Rh
F2
(400°)
(700° → −196°); TbF4 (t)
RhF5, cr., red, isostr. to (RuF5)4, Rh—F 1.99 (br.), 1.82 (termnl.) 6)
CsF (IF5)
Cs[RhF6], cr., reddish brn., isostr. to Cs[PtF6]
M[RhF6], M = [O2], [KrF6] 7)
t (−Kr)
RhF6, cr., dark red, m.p. 70; + H2O → O2, mol.: octahedron
> 20° (−F2)
H2S (350°)
Rh(CN)3 · 3 H2O↓, insol. in KCN
Rh(SCN)3 · 2 H2O, cr., orange
H2SO4
K3[Rh(CN)6], cr., colrl.
K3[Rh(SCN)6], cr., red
Rh(HS)3↓, brn.
t
Rh2S3, cr., blk., insol. in aq. reg., t → Rh3S4; in struct.: framework of octahedra
RhIII
H2S
[Rh(NH3)6]X3, cr., colrl. 20)
[Rh(NH3)5X]Haln, X = Hal, OH, H2O, NO3, cr., yel.
[Rh(NH3)4Cl2]X, X = Hal, NO3 (·H2O), cr., yel.
[Rh(NH3)3X3], X = Cl, NO2
[Rh(PR3)3Cl3], hydrogenation cat.
[Rh(CO)2F3]2, cr., orange, volatile
M2[Rh(NH3)3(SO3)2(SO3Na)]
K[Rh(NH3)2(NO2)4], cr., colrl.
M2[Rh(NH3)X5], X = Cl (cr., red), NO2 (colrl.)
[Rh(C5H5)2]+X−, dicyclopentadienylrhodium(III) salts, v. stable, diamagn. (cf. CoIII)
0
2+
3+
4+
6+
[RhCl6]3−, pink, diamagn. (d6), octahedron (d2sp3) ion, Kst = 10^12
CeIV
H2O (−Cl2)
[RhCl6]2+, grn., low-spin (d5), octahedron
Cl− H2O
[RhCln(H2O)6−n](n−3)−, n = 3, 4, 5, red ions
Cl− H2O
[RhCln(H2O)6−n](3−n)+, n = 1, 2, yel. ions
Cl− H2O (HClO4)
N2H4; EtOH; HCHO
Rh↓, blk.
anod. Ox (HClO4)
[Rh(H2O)6]3+ H2O ⇌ H+ [Rh(H2O)5(OH)]2+, yel., octahedra, diamagn. ions stable to Ox
[Rh2(H2O)n]4+ 18)
OH−
[Rh2(μ-OH)2(H2O)8]4+ ⇌ [Rh3(μ-OH)4(H2O)10]5+ 18)
OH−
[Sn(OH)6]4−
Rh(OH)2↓, blue
Rh(OH)3·H2O↓, yel.
O2 (OH−)
RhO2 · n H2O↓, grn.
[H2RhO4] (?), viol. soln.
OCl−
[RhO4]2− (?), blue ion, known only in soln.
NH4OH
[Rh(NH3)5(H2O)]3+, yel. ion
H2O
NH3 + EtOH
[Rh(NH3)6]3+, colrl. ion