Transition Elements

Third Year ,Chemistry Group.

Group (III) elements:Sc…($3d^1 4s^2$, scandium),

Y…($4d^1 5s^2$,Yttrium) and La …($5d^1 6s^2$, Lanthanum)

General properties:

M= refer to any element of this group.

M= trivalent element, they are rare and tend to form the following products: M_2S_3 with S,MH_3 with hydrogen,MX_3 with halides MX_3,with oxygen hydroxide oxide or hydride of oxide {ScO(OH)} and {,$Sc_2O3.nH2O$},with K2SO4 double sulfite salt is formed{ $La_2(SO_4)$. K_2SO_4 as ex.}.

Finally,with neutral ligands the following complexes are formed: $[Sc(DMSO)_6]$ $(ClO4)_3$ and $[Sc(bipy)_3]$ $(ScN)_3$.

Fourth Group: Titanium (Ti, $3d^2 4s^2$), Zirconium (Zr,$4d^2 5s^2$), Hafnium (Hf ,$5d^2 6s^2$).

Reactions of Ti element :Two ORES are known, ilmenite ($FeTiO_3$) and rutile (TiO_2).With dilute acides or bases at room temp.no reaction is

observed.With HCl and heat ,$TiCl_3$ is formed and with HNO_3 and heat TiO_2 is formed.With nonmetals stable and strong productes are formed e.g. TiN,TiC, TiS,TiX_4,TiH_2.

Extracting Ti element from rutile :

TiO_2 +C +Cl_2 …….$TiCl_4$ +CO_2 (…Mg)… Ti+$MgCl_2$

TiO_2 +C+ I_2 ……. TiI_4 …….Ti +2I_2

Reactions of Ti(+2): TiO +2 HX……..TiX2 + H2O

TiX4 + Ti …….. 2TiX2 ,

2 TiX3 ……..TiX2 +TiX4

TiO_2 +Ti … 2 TiO Conclusion: Ti(+2) form oxide and halides via reduction or self ox-red process.

Reactions of Ti (+3): The halides and oxide of Ti(+3)obtained via:

Ti(+4)…zn/H+ Ti(+3) e.g. $TiCl_4$ +H_2 --- $TiCl_3$ then $TiCl_3$ produce[$Ti(H_2O)]X_3$ on dissolved in water.With OH- $Ti(OH)_3$ is formed.

TiO_2 +$TiCl_4$ ---- Ti_2O_3 +n H_2O

Ti(+3) form complexes e.g. $[TiCl_5(H2O)]^{2-}$, $[TiF6]^{3-}$ and $[Ti(acac)_3]$.

<u>Reactions of</u> Ti(+4): $TiO_2 + C + Cl_2$ ---$TiCl_4$ (liquid,acid).

$TiCl_4 + R_2O$ –$TiCl_4.R_2O$

$TiCl_4 + H_2O$ – TiO_2 +HCl

Ti(+4)salt + heat -----TiO_2

$TiCl_4$ +HF----TiF_4 or $[TiF_6]^{2-}$ also Ti Br^4, TiI_4 [,$TiCl_6]^{2-}$ [,$TiCl_5(H_2O)$]- are also formed.

_____ _____ _____