

Transition Elements

Third Year ,Chemistry Group.

Group (III) elements:Sc...(3d¹4s², scandium),

Y...(4d¹ 5s², Yttrium) and La ...(5d¹6s², Lanthanum)

General properties:

M= refer to any element of this group.

M= trivalent element, they are rare and tend to form the following products: M₂S₃ with S, MH₃ with hydrogen, MX₃ with halides MX₃, with oxygen hydroxide oxide or hydride of oxide {ScO(OH)} and {,Sc₂O₃.nH₂O}, with K₂SO₄ double sulfite salt is formed{ La₂(SO₄). K₂SO₄ as ex.}.

Finally, with neutral ligands the following complexes are formed: [Sc(DMSO)₆] (ClO₄)₃ and [Sc(bipy)₃] (ScN)₃.

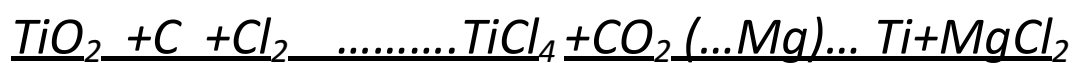
Fourth Group: Titanium (Ti, 3d²4s²), Zirconium (Zr,4d²5s²), Hafnium (Hf ,5d²6s²).

Reactions of Ti element :Two ORES are known, ilmenite (FeTiO₃) and rutile (TiO₂).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 products are formed e.g.

$TiN, TiC, TiS, TiX_4, TiH_2$.

Extracting Ti element from rutile :

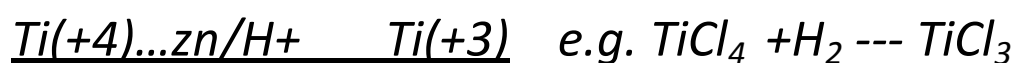


Reactions of Ti(+2): $TiO + 2 HX \dots\dots TiX_2 + H_2O$

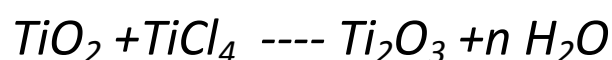


$TiO_2 + Ti \dots 2 TiO$ Conclusion: Ti(+2) form oxide and halides via reduction or self ox-red process.

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

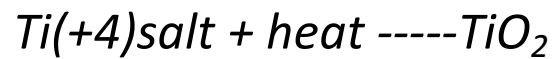
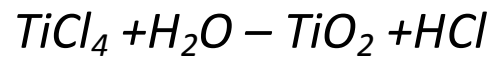
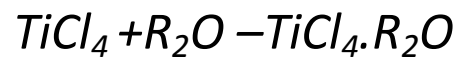


then $TiCl_3$ produce $[Ti(H_2O)]X_3$ on dissolved in water. With OH^- $Ti(OH)_3$ is formed.



Ti(+3) form complexes e.g. $[TiCl_5(H_2O)]^{2-}$, $[TiF_6]^{3-}$ and $[Ti(acac)_3]$.

Reactions of Ti(+4): $\text{TiO}_2 + \text{C} + \text{Cl}_2 \rightarrow \text{TiCl}_4$
(liquid, acid).



$\text{TiCl}_4 + \text{HF} \rightarrow \text{TiF}_4$ or $[\text{TiF}_6]^{2-}$ also Ti Br_4 , TiI_4 , $[\text{TiCl}_6]^{2-}$
 $[\text{TiCl}_5(\text{H}_2\text{O})]^-$ are also formed.
