

## NICKEL (Ni)

### Extraction

The typical ores include:

Millerite, NiS,

Garnierite (Ni,Mg)SiO<sub>3</sub>.xH<sub>2</sub>O

The ore is crushed and concentrated by froth floatation. The ore is then roasted in air to remove much of the sulphur as sulphur dioxide. The product is passed through a series of complex stages that result into formation of nickel (II) oxide (NiO)

The oxide is heated to about 60<sup>0</sup>C in a stream of carbon monoxide gas to form the volatile nickel carbonyl, Ni(CO)<sub>4</sub>. The nickel carbonyl distills off leaving impurities behind. When heated to 200<sup>0</sup>C it decomposes to give very pure nickel



*Impure*



*Pure*

### Properties of nickel:

It is hard lustrous metal which is very malleable and ductile.

It forms compounds in oxidations state of +2.

- (i) It is not attacked by air or water at room temperature, but when strongly heated it decomposes to form Nickel (II) oxide



- (ii) Red hot Nickel react with steam to form Nickel (II) oxide



- (iii) Reaction with other non-metals

It combines with halogens and Sulphur on heating.



- (iv) Reaction with acids

Nickel reacts slowly with most strong acids to form corresponding salts but concentrated nitric acid renders nickel passive.



## Compounds of Nickel

It forms compounds in oxidation state +2 few or its compound are known in oxidation state of +3

(a) *Nickel (III) compounds*

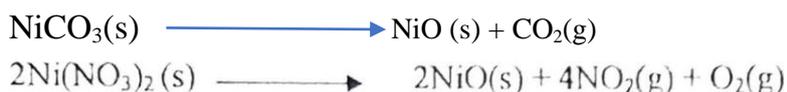
Hydrated dinickel trioxide ( $\text{Ni}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ )

(b) *Nickel (II) compound*

These are the most Important and most stable compounds of Nickel

(i) *Nickel (II) oxide*

It is a green basic solid obtained by heating nickel (II) carbonate or nickel (II) nitrate



Nickel (II) oxide is a basic oxide that dissolves in dilute acids to give green solution of hexaqua nickel (II) ion ( $\text{Ni}(\text{H}_2\text{O})_6^{2+}$  ion).



(ii) *Nickel (II) sulphate*

Made by reacting nickel (II) oxide, hydroxide or carbonate with dilute sulphuric acid and crystallizing.



(iii) *Nickel (II) hydroxide*

This can be precipitated as a pale green gelatinous solid by adding sodium hydroxide solution to nickel (II) solution.



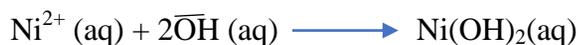
It is basic and reacts with acids but not dilute alkalis

The pale green precipitate dissolves in aqueous ammonia to form a purple blue complex solution

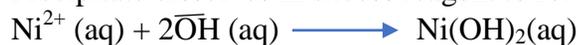


### Qualitative analysis of Ni<sup>2+</sup> ions:

- (i) *Reaction with sodium hydroxide solution*  
Green precipitate insoluble in excess reagent



- (ii) *Reaction with aqueous ammonia*  
Precipitate dissolves in excess reagent to form a purple blue



- (iii) *Reaction with ammonium sulphide solution*

Black precipitate is formed

- (iv) *Reaction with potassium cyanoferrate (II) solution and ammonia solution*

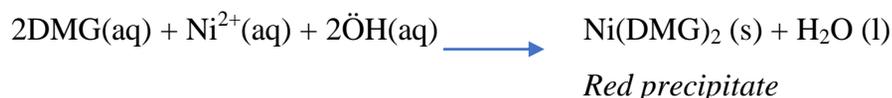
Green precipitate soluble in aqueous ammonia



- (v) *Reaction with potassium cyanoferrate (III) solution.*



- (vi) *Reaction with aqueous ammonia and dimethylglyoxime (DMG)*



*Red precipitate* This is used as a confirmatory test for Ni.