

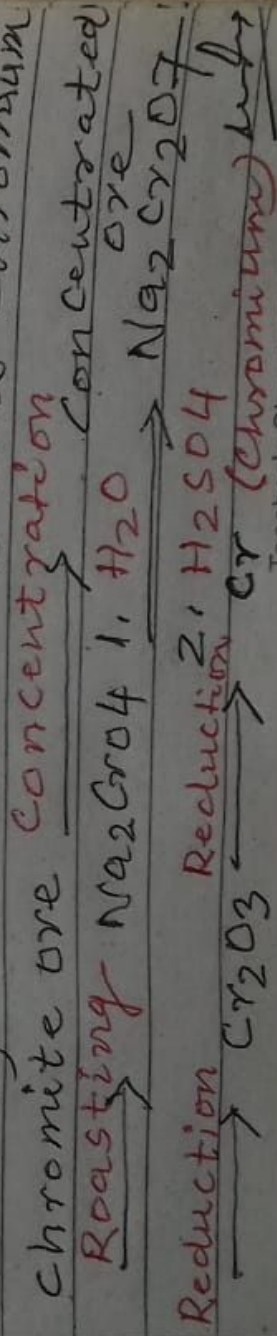
Degree II Chemistry Hons Paper III

Chromium Metal

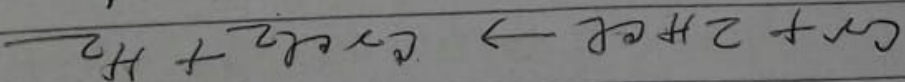
The important ore is Chromite or Chrome iron stone ($FeO \cdot Cr_2O_3$)

Extraction: - First of all, ore is being powdered then it is concentrated by gravity separation method and is roasted in the presence of air with the excess quantity of Na_2CO_3 where sodium chromate Na_2CrO_4 is formed. This sodium chromate is then extracted with water and is acidified with H_2SO_4 where sodium dichromate $Na_2Cr_2O_7$ is obtained.

Now sodium dichromate is reduced with carbon. Then Cr_2O_3 is formed which on further reduction either by sugar charcoal (Davy's process) or by Al-powder (Goldschmidt's aluminothermic process) is converted into chromium chromite ore concentration



of chromic chloride in air and cold HCl

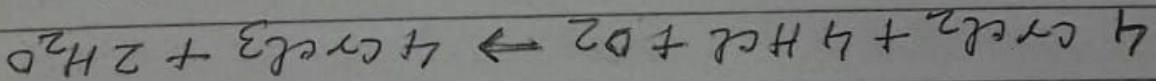


Here it is in +2 state which is

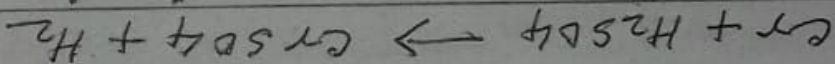
oxidised into +3 state in presence of

air and this is the reason that the colour

of the above solution becomes green.

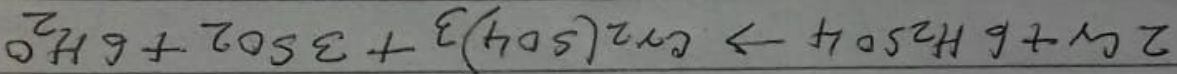


(2) With dil H₂SO₄ it forms chromic (II) sulphate



(3) With hot and conc H₂SO₄ it gives chromic

(III) sulphate.



(4) It is insoluble in dil HNO₃

Uses: - It is mainly used in the formation

of alloys.

Cobalt Metal

The important ores are: -

(1) Cobaltite - CoAsS

(2) Smaltite - CoAs₂

Extraction: - First of all ore is

powdered and then it is roasted where

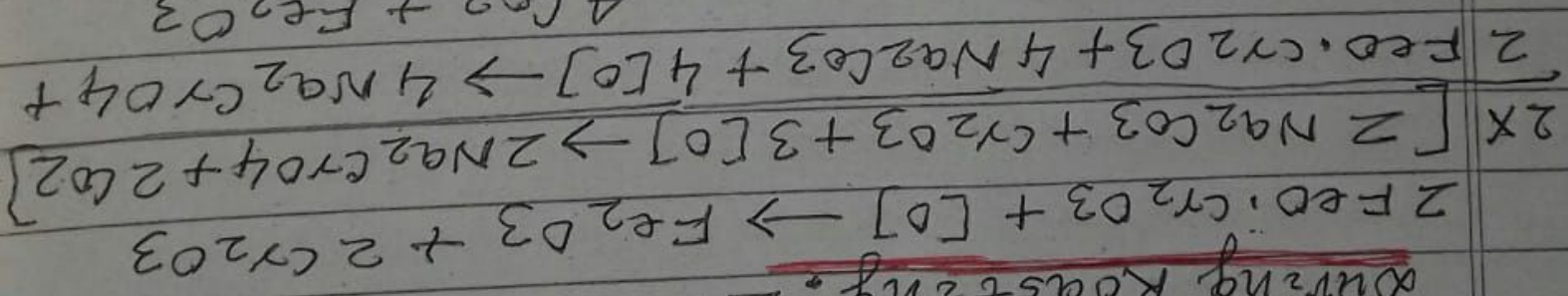
most of the sulphur and Arsenic are removed

out. Then lime stone and sand is added

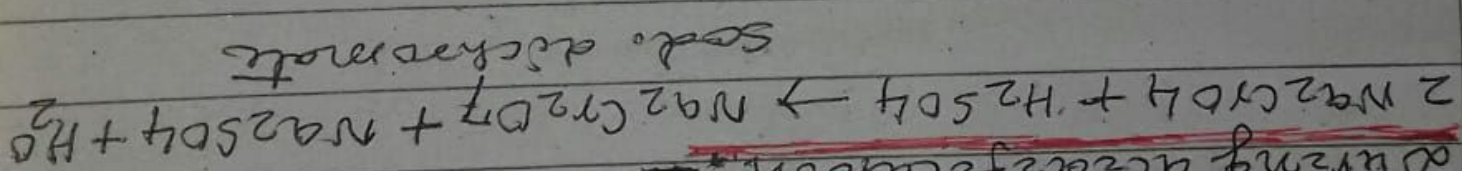
into the roasted ore and is smelted

Important reactions involved during extraction

During Roasting:-

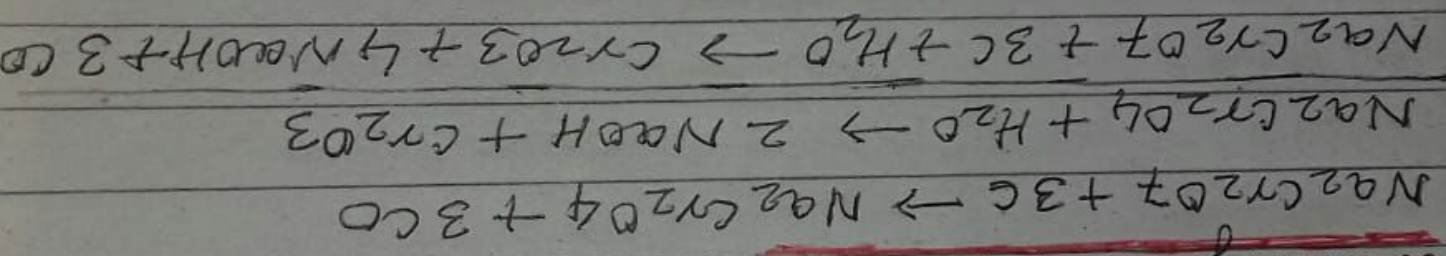


During acidification:-

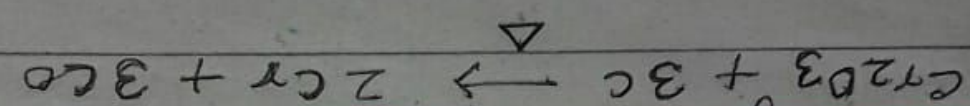


sol. dichromate

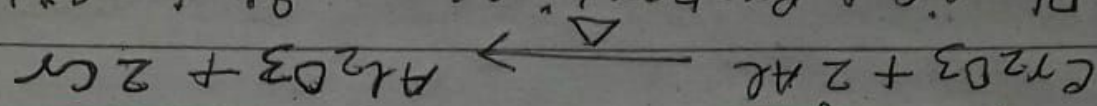
During reduction:-



During Davy's Process:-



During Goldschmidt's Process:-



Physical Properties:- It is a silvery white crystalline metal. It is malleable.

Its M.P. is 1830°C and B.P. is 2250°C .

Chemical Properties:-

(1) At ordinary temperature it is unaffected by air and water. It produces blue solution

into the blast furnace. of iron is present then it is removed but in the form of slag. At this stage Ni, Co, Fe etc are removed but which is called "Speiss". Speiss is then roasted with NaCl where the metal is converted into NaCl chloride. Roasted ore is extracted with water then lime stone is added. where iron, Arsenic and Antimony are precipitated. In the filtrate, Na_2CO_3 is added then Cu is removed out and the Co & Ni remains in the form of their chlorides. Lime and Bleaching Powder is then added where Cobalt is precipitated in the form of its hydroxides. Precipitate is then dried and is heated. In this way cobalt oxide is obtained which upon reduction gives metal.

ORE

1. Roasting
2. Smelting
3. Filtration

1. Extraction
 2. Lime stone
 3. Filtration

Chlorides of Co and Ni

Roasted mass

NaCl

Roasted with

Na_2CO_3

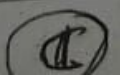
Filtrate

Chlorides of Co and Ni

Roasting

Smelting

Filtration



Nickel Metal

The important ores are :-

(1) Suddbury and

(2) Garnite - $\text{NiMgSiO}_3 \cdot \text{H}_2\text{O}$

Extraction :- It is extracted from its important ore Suddbury. First of all

ore is concentrated by froth floatation

process and then roasted. As a result

of which Fe is converted into FeO,

the roasted ore is then smelted into

a blast furnace with coke and quartz

where total Fe is removed but in the

form of slag (FeSiO_3). The product

so obtained is called "MATTE".

Matte is heated in the presence

of air in a Bessemer converter,

in this way the remaining Fe is oxidised

into FeO and is removed out in the

form of a silicate slag.

The Bessemerised matte

is again roasted where NiS, CuS

and As are converted into their

respective oxides. The mixture of the

oxide is thus extracted with dil H_2SO_4

Chlorides of 1. Lime \rightarrow $Ca(OH)_3 \xrightarrow{\Delta} \text{oxide of } CO$

2. Breaching powder \rightarrow $CO \& N_2$

Reduction CO (cobalt metal)

Important reactions involved: -

$CO_2 + Ca(OH)_2 \rightarrow Ca(OH)_2 + CaCO_3$

$2 Ca(OH)_2 + H_2O + Ca(OH)_2 \rightarrow 2 Ca(OH)_3 + CaCO_2$

$12 Ca(OH)_3 \xrightarrow{\Delta} 4 Ca_3O_4 + 18 H_2O + O_2$

Reduction $9 CO + 4 Al_2O_3 \rightarrow 3 CO_2 + 8 Al$

Properties: -

It is a white metal and is very hard.

At ordinary temperature, it is not affected by dry and moist air.

At red hot it oxidises slowly.

It is less affected by dil HCl or H₂SO₄

$CO + 2 HCl \rightarrow COCl_2 + H_2$

It is readily soluble in nitric acid when it is heated with ammonia then nitride $Co_4 N_2$ is formed.

Uses: -

1. In the preparation of alloys
2. In the process of electroplating
3. In the manufacturing of surgical instruments.