

59 Nickel

Nickel, when added in small quantity to iron, increases its properties manifold and makes the product hard and stainless. The reason behind the demand of primary nickel in the entire world is for the production of stainless steel. When it is used in plating, it makes the surface tarnish-resistant and provides polished appearance.

Nickel is not produced from primary sources in the country and the entire demand is met through imports. However, it is being recovered as nickel sulphate crystals, a by-product obtained during copper production.

OCCURRENCES & RESOURCES

Important occurrence is nickeliferous limonite in the overburden of chromite in Sukinda Valley, Jajpur district, Orissa, where it occurs as oxide. A suitable process is being developed for its utilisation. Nickel also occurs in sulphide form along with copper mineralisation in East Singhbhum district, Jharkhand.

In addition, it is found associated with uranium deposits at Jaduguda, Jharkhand and process is being developed for its recovery. Other reported occurrences of nickel are from Karnataka, Kerala and Rajasthan. Polymetallic sea nodules are another source of nickel.

As per UNFC, as on 1.4.2010, the total provisional resources of nickel ore have been estimated at 189 million tonnes. About 92% resources; i.e., 175 million tonnes are in Odisha. The remaining 8% resources are distributed in Jharkhand (9 million tonnes), Nagaland (5 million tonnes) and Karnataka (0.23 million tonnes) (Table - 1).

INDUSTRY

Nickel sulphate is produced as a by-product at the Ghatsila Copper Smelter of HCL in Jharkhand. The sulphide copper ore from Ghatsila area contains nickel in small quantity along with other important metals like gold and cobalt. The installed annual capacity of the plant to produce nickel sulphate is 390 tonnes. However, the production of nickel sulphate has not been reported since 2004-05. Sterlite (Tuticorin) has developed innovative method to produce pure commercial grade nickel sulphate from electrolyte by solvent crystallisation. The pilot-scale trials are in progress.

Nickel sulphate in the country is the most important compound used commercially in nickel plating, in dip baths for enamelling, in preparation of nickel compounds and as a catalytic nickel.

**Table –1 : Reserves/Resources of Nickel as on 1.4.2010 (P)
(By Grades/States)**

(In million tonnes)

Grade/State	Total reserves (A)	Remaining resources					Total (B)	Total resources (A+B)
		Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333		
		STD221	STD222					
All India : Total	–	21	21	31	53	63	189	189
By Grades								
+ 0.9% Ni	–	13	8	–	18	3	42	42
0.5 to 0.9% Ni	–	8	13	31	21	21	94	94
(+)0.5% Ni, unclassified	–	–	–	–	14	39	53	53
Not-known	–	–	–	–	–	–	–	–
By States								
Jharkhand	–	–	–	–	2	7	9	9
Karnataka	–	–	–	–	–	–	–	–
Nagaland	–	–	–	–	–	5	5	5
Odisha	–	21	21	31	51	51	175	175

RESEARCH & DEVELOPMENT

Department of Ocean Development

The Department of Ocean Development, under its Polymetallic Nodules (PMN) Programme, has set up on behalf of HZL; a semicontinuous demonstration pilot plant to process 500 kg per day polymetallic nodules for extraction of metal values at Udaipur. The Department of Ocean Development collected 45 tonnes nodules for this purpose. Regional Research Laboratory (RRL) (now IMMT), Bhubaneswar and HZL, Udaipur, are pursuing the R&D efforts for optimising the metal recovery/processing steps.

Institute of Minerals and Materials Technology (formerly RRL), Bhubaneswar

The Nickel Technology Proving Plant set up at Institute of Minerals and Materials Technology (formerly RRL), Bhubaneswar, is a joint (R&D) pilot project of Council of Scientific & Industrial Research (CSIR) and HZL. In this project, all the experimental studies on nickel plant have been completed.

IMMT is also engaged in extraction of nickel and cobalt from lateritic nickel/chromite overburden of Orissa through microbial route using acidophilic micro-organism. Up to 35% Ni and 50% Co recovery was achieved through mechano-chemical activation and pelletisation of chromite overburden. In a span of 60 days, 70% Ni and 60% Co recovery was achieved. The technology could be exploited in ultramafic complexes of Sukinda Valley. At present, it is to be scaled up to 10-tonne scale to generate process data and basic engineering details with support from OMC Ltd for its commercial implementation at Sukinda mine site.

IMMT developed a process for production of nickel concentrate from chromite overburden/nickeliferous lateritic ores. A process was also developed for extraction of nickel from solutions containing nickel and sodium sulphate and an improved process for dissolution of nickel-cobalt mixed sulphides. Patents were granted for all the three processes in India.

USES

The most important use of nickel is in production of stainless steel and other corrosion-resistant alloys. It is used in plating to make hard, tarnish-resistant, polished surfaces. Conventional plating is still much in favour but other techniques, such as electrolytic coating or sintered slurry coating, are used for applications like turbine blades, helicopter rotors, rolled steel strips and

extrusion dies. Nickel is an important ingredient in coins. Finely divided nickel is used as a catalyst in hydrogenation. Other commercial uses are in ceramics, special chemical vessels, rechargeable nickel-cadmium storage batteries, electronic circuits, in computer hard discs, jewellery, green colouring of glass and preparation of nickel compounds.

CONSUMPTION

World over stainless steel is the major end-use sector of nickel having over 66% consumption share. Other uses include non-ferrous alloys (12%), electroplating (11%), other steel alloys, including casting (10%) and other chemical applications, like nickel-cadmium battery (6%). Domestic reported consumption of ferro-nickel during 2007-08, 2008-09 and 2009-10 was 2,113 tonnes, 2,120 tonnes and 2,124 tonnes, respectively, all in alloy-steel industry.

SUBSTITUTES

Aluminium, coated steels, plain chromium steels and plastics can replace stainless steel to a limited extent in many construction and transportation applications. Nickel-free speciality steels are sometimes used in place of stainless steel within the power-generating, petrochemical and petroleum industries. Titanium alloys or speciality plastics can substitute nickel metal or nickel-based alloys in highly corrosive chemical environments.

TRADE POLICY

As per Foreign Trade Policy, 2009-2014, imports of nickel ores & concentrates (heading no.2604) and metal (heading no.7503) are allowed freely. However, some forms of metal waste & scrap (ITC-HS Code No.7503 0090) are restricted.

WORLD REVIEW

The world reserve of nickel is estimated at 71 million tonnes of metal content. Australia (37%), New Caledonia (10 %), Russia (9 %), Cuba (8 %), Canada & Brazil (6% each), South Africa (5%) and Indonesia (4%) together accounted for around 85% nickel reserves (Table-2). The identified land-based reserves analysing on an average of 1% nickel or more contain at least 130 million tonnes nickel. About 70% of nickel reserves are in laterites and 30% in sulphide deposits. In addition, extensive deep-sea resources of nickel are in manganese crusts and nodules, covering large areas of the ocean floor, particularly in the Pacific Ocean.

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**Table – 2 : World Reserves of Nickel
(By Principal Countries)**

(In '000 tonnes of nickel content)

Country	Reserve
World: Total	71000
Australia	26000
Botswana	490
Brazil	4500
Canada	4100
China	1100
Colombia	1700
Cuba	5500
Dominican Republic	840
Greece	490
Indonesia	3200
New Caledonia	7100
Philippines	940
Russia	6600
South Africa	3700
Spain	57
USA	–
Venezuela	490
Other countries	3800

Source: Mineral Commodity Summaries, 2010.

**Table – 3 : World Mine Production of Nickel
(By Principal Countries)**

(In '000 tonnes of metal content)

Country	2007	2008	2009
World: Total	1616	1581	1412
Australia	184	200	166
Brazil	58	67	67
Canada	255	260	136
China	66	79	81
Colombia	100	77	72
Cuba	74	67	65
Dominican Republic	29	19	–
Indonesia	201	219	203
New Caledonia	125	102	92
Philippines	91	81	137
Russia ^(e)	280	267	262
South Africa	38	32	35
Other countries	115	111	96

Source: World Mineral Production, 2005-2009.

In 2009, world mine production of nickel declined to 1.41 million tonnes (11% less) as compared to 1.58 million tonnes in the previous year. Russia (19%), Indonesia (14%), Australia (12%), Canada & Philippines (10% each), New Caledonia (7%) and Colombia (5%) were the principal producers (Table-3). Philippines, South Africa and China showed increase in production, whereas all other countries showed decline in production, significant among them are Canada, Australia and Indonesia.

During 2009 & 2010 due to improvement in global economy many nickel mines/producers restarted their projects. Significant among them were Vale Inco of Canada, Miitel Nickel mine in Western Australia and Minmetals in China. Rio Tinto acquired a mining permit in Indonesia with expected annual capacity of 46,000 tonnes Nickel. Lounge Lizard Nickel Sulphide deposit of Kagara Ltd and Poseidon Nickel's Mt. Windarra project in Western Australia started producing during 2010.

FOREIGN TRADE

Exports

Exports of nickel and alloys including waste & scrap decreased marginally to 1,524 tonnes in 2009-10 from 1,565 tonnes in the previous year. Out of the total alloys and scrap exported in 2009-10, nickel alloys were 1,375 tonnes, while nickel waste & scrap were 149 tonnes. Exports were mainly to USA (17%), Thailand (7%) and Belgium (5%) (Tables - 4 to 6).

Imports

During 2009-10, imports of nickel ores & concentrates declined drastically to 91 tonnes from 346 tonnes in the previous year. Imports were only from Canada. Imports of nickel & alloys including scrap were 23,909 tonnes in 2009-10 compared to 20,514 tonnes in the previous year. Out of total alloys and scrap imported in 2009-10, nickel alloys were 22,922 tonnes, while nickel waste & scrap rose to 987 tonnes from 320 tonnes in the previous year. Imports in 2009-10 were mainly from Russia (24%), Australia (17%), Finland (9%) and Norway (8%) (Tables - 7 to 11).

**Table – 4 : Exports of Nickel and Alloys Incl. Scrap
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	1565	1104883	1524	1103460
USA	164	158043	255	143394
Thailand	111	102192	100	84099
Belgium	1	893	75	73161
Japan	293	119194	100	63672
Latvia	–	–	53	55286
Singapur	38	18761	63	54414
France	31	23748	40	40201
Turkey	22	23806	36	34728
Hungary	170	177071	20	20789
Netherlands	137	102986	16	17319
Other countries	598	378189	766	516397

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**Table – 5 : Exports of Nickel & Alloys
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	1500	1074313	1375	1041448
USA	164	158042	164	134981
Thailand	111	102192	100	84099
Belgium	1	893	75	73161
Latvia	–	–	53	55286
Singapore	38	18761	63	54414
France	31	23748	40	40201
Turkey	22	23806	36	34728
Japan	237	92576	37	31030
Hungary	170	177071	20	20789
Netherlands	137	102986	16	17319
Other countries	589	374238	717	495440

**Table – 6 : Exports of Nickel Waste & Scrap
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	65	30570	149	62012
Japan	56	26618	63	32642
Spain	–	–	38	15052
USA	++	1	37	8413
Germany	–	–	10	5379
Korea Rep. of	–	–	1	437
Kirghyzstan/Kirghizia	–	–	++	87
Nepal	++	40	++	2
Hong Kong	++	113	–	–
Tanzania	1	72	–	–
UK	8	3723	–	–
Other countries	++	3	–	–

**Table – 7 : Imports of Nickel Ores & Conc.
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	346	160035	91	80938
Canada	51	42768	91	80938
Albania	48	1719	–	–
Belgium	3	1884	–	–
Indonesia	46	1647	–	–
Korea Rep. of	29	973	–	–
Netherlands	147	105707	–	–
Russia	4	4415	–	–
UAE	18	921	–	–
Other countries	++	1	–	–

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**Table – 8 : Imports of Nickel and Alloys Incl. Scrap
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	20514	19453631	23909	19473718
Russia	6978	5786393	5634	4497734
Australia	2318	1612907	4160	3357258
Finland	1904	1952929	2251	1675001
Norway	1216	1295554	1962	1527532
Canada	1338	1393979	1671	1361864
UK	1699	1965266	1136	933275
Germany	360	690935	755	631726
USA	677	783209	459	599517
France	392	466103	567	376256
Italy	252	506650	267	325127
Other countries	3380	2999706	5047	4188428

**Table – 9 : Imports of Nickel & Alloys
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	20194	19362231	22922	19242826
Russia	6978	5786393	5606	4482844
Australia	2318	1612907	4160	3357258
Finland	1877	1935312	2251	1675001
Norway	1216	1295554	1962	1527532
Canada	1338	1393979	1671	1361864
UK	1673	1960778	1033	914223
USA	600	769217	425	592817
Germany	360	690935	441	575501
France	360	458832	567	376256
Italy	252	506650	220	315675
Other countries	3222	2951674	4586	4063855

**Table – 10 : Imports of Nickel Waste & Scrap
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	320	91400	987	230892
Germany	-	-	314	56225
Turkey	2	1637	125	36842
UAE	22	9504	70	26151
UK	26	4488	103	19052
Kuwait	-	-	36	14964
Russia	-	-	28	14890
Pakistan	10	3563	36	12474
USA	77	13992	34	6700
Sweden	70	18697	4	878
Finland	27	17617	-	-
Other countries	86	21902	237	42716

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**Table – 11 : Imports of Nickel
(By Items)**

All Items	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Items	20514	19453631	23909	19473718
Nickel & alloys	20194	19362231	22922	19242826
Nickel & alloys : unwrought	869	794118	2320	1801998
Nickel except electroplated anode	16077	13668683	17593	13908899
Nickel : worked	31	26701	21	16097
Nickel & alloys : worked	346	669627	373	462519
Bars,rods,plates,sheets foils of nickel	419	606366	590	692069
Bars,rods,plates,sheets foils of nickel alloys	1923	2949652	1404	1671838
Electroplated anode of nickel	10	26318	5	7704
Nickel Mattes	57	40340	++	241
Nickel oxide / sinters	27	34131	264	336880
Nickel & alloys, worked NES	435	546295	352	344581
Nickel scrap	320	91400	987	230892

FUTURE OUTLOOK

About 60 to 70% of world nickel demand is for the production of stainless steel. Nickel accounts for 10 to 20% input cost in stainless steel production depending on the nickel content. The future outlook for nickel depends mainly on the production of stainless steel which is one of the main drivers for nickel produced, the world over.

The estimated demand for nickel in the country is expected to grow at 5% per annum. India will have no option but to depend on imports for this metal till a technology to recover nickel from the overburden of chromite ore in Odisha is established on a commercial scale.