Indian Minerals Yearbook 2018

(Part- II Metals and Alloys)

57th Edition

NICKEL

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
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January, 2020

12 Nickel

Nickel is a lustrous, silvery-white metal. It is the fifth most common element of earth's crust. It has a melting point of 1,453°C, relatively low thermal & electrical conductivities, high resistance to corrosion & oxidation, excellent strength & toughness at high temperatures and capable of getting magnetised. It is attractive and very durable as a pure metal and alloys readily with other metals.

Nickel is not produced from primary sources in the country and the entire demand is met through imports. However, HCL is planning to recover nickel as a by-product in the form of nickel sulphate during refining of copper at Ghatsila copper smelter of Hindustan Copper Ltd (HCL) in Jharkhand.

OCCURRENCES AND RESERVES & RESOURCES

Nickel occurs principally as oxides, sulphides and silicates in India. Important occurrence is nickeliferous limonite in the overburden of chromite in Sukinda Valley, Jajpur district, Odisha. In addition, nickel is found associated with uranium deposits at Jaduguda, Jharkhand and a process is being developed for its recovery. Resources are spread over in Singhbhum East district of Jharkhand and Jajpur, Keonjhar & Mayurbhanj districts of Odisha.

As per NMI database as on 1.4.2015 based on UNFC, Resources of nickel are estimated at 189 million tonnes. The entire resources fall under Remaining Resources category. The State of Odisha is endowed with the largest share of resources of nickel ore in the country at 175 million tonnes (92%). These resources are mainly found to occur in three districts, namely, Jajpur (140 million tonnes), Mayurbhanj (27 million tonnes) and Keonjhar (8 million tonnes). Jharkhand has 9 million tonnes (5%) resources most of which are in Singhbhum (East) district. Nagaland has 5 million tonnes (3%) resources which predominantly are in Kiphire district (Table- 1).

EXPLORATION & DEVELOPMENT

The exploration and development details, if any, are covered in the Review on "Exploration & Development" in "General Reviews".

Table –1: Reserves/Resources of Nickel Ore as on 1.4.2015
(By Grades/States)

(In million tonnes)

Grades/States	Total Reserves (A)	Remaining Resources						Total Resources (A+B)
		Pre-feasibility		Measured	Indicated	Inferred	Total	
		STD221	STD222	STD331	STD332	STD333	(B)	
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

Figures rounded off

INDUSTRY

HCL produced nickel sulphate as a by-product at its Ghatsila Copper Smelter in Jharkhand. The sulphide copper ore from Ghatsila area contains nickel in small quantity along with other important metals like gold and cobalt. HCL by means of imported EMEW technology from Canada, developed capabilities to recover LME- Nickel a grade cathode from lower concentration of copper in spent electrolyte, which otherwise was not possible by conventional means. Besides this, the technology also enabled HCL to recover nickel from the spent electrolyte at ICC refinery. Another technology of Acid purification Unit (APU) again imported from Canada, and that which is an eco-friendly technology allowed reduction of liquid effluent and facilitates recovery of nickel in the downstream process. However, production of nickel sulphate has not been reported since 2004-05. The Nicomet Industries Ltd located at Goa is presently engaged in production of nickel metal and their derivatives and its annual production capacity from its Goa plant is about 5,400 MTPA.

RESEARCH & DEVELOPMENT

India's first facility to produce nickel, a metal for which India is completely dependent on imports, has been launched by the Hindustan Copper Limited (HCL) at its Indian Copper Complex (ICC) at Ghatsila in Jharkhand. The new facility "Nickel, Copper and Acid Recovery Plant" is the first facility in India to produce nickel metal of London Metal Exchange (LME) grade from primary resource. The annual demand for pure nickel in India is around 45,000 million tonnes and its domestic market is totally dependent on imports.

USES

Sectoral uses of nickel metal are in the areas of stainless steel making; catalysis chemical industries, as an electroplating material; heat resistant alloys; alloying element for non-ferrous metals; space, defence & rocket industries; and nickel cadmium batteries.

Nickel is used in many specific and recognisable industrial and consumer products including stainless steel, alnico magnets, coinage, for filters & binders, rechargeable batteries, foundry, electric guitar strings, microphone capsules and special alloys. It is also used for plating and as green tint in glass. Nickel is predominantly an alloy metal & its chief use is in the nickel steel & nickel cast iron of which there are many varieties. It is also widely used in many other alloys, such as, nickel bronze & brasses and alloys with copper, chromium, aluminium, lead, cobalt, silver & gold. It is used as catalyst which is key to several important reactions including the hydrogenation of vegetable oils, reforming of hydrocarbons and in the production of fertilizers, pesticides and fungicides.

Nickel sulphate is an important compound used commercially in the country in nickel plating, in dip baths for enamelling, in preparation of nickel compounds and as a catalytic nickel. Nickel based alloys, like stainless steel with higher nickel content are used for more demanding applications, such as, in gas turbines and some chemical plants.

CONSUMPTION

World over about 65% of nickel is used in the manufacturing of stainless steel and 20% in other steel and non-ferrous (including super alloys) components often used for highly specialised industrial, aerospace and military applications. About 9% is used in plating and 6% in other uses, including coins and a variety of nickel chemicals.

SUBSTITUTES

Aluminium, coated steels, plain chromium steels and plastics are the common substitutes that could replace stainless steel to a limited extent in many construction and transportation applications. Low-nickel, duplex, or ultra-chromium stainless steels are being substituted for austenitic grades in construction. 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 are in use as materials that could substitute nickel metal or nickel-based alloys in applications to resist corrosion in highly corrosive chemical environments. Lithium-ion batteries are replacing nickel-metal hydride batteries in many applications.

TRADE POLICY

As per Foreign Trade Policy, 2015-2020, imports of nickel ores & concentrates (heading no. 2604) and metal (heading no. 7503) are allowed, free. However, some forms of metal waste & scrap (ITC-HS Code No. 7503 0090) are restricted.

WORLD REVIEW

The world reserves of nickel are estimated at 89 million tonnes of metal content. Indonesia (24%), Australia (21%), Brazil (12%), Russia (9%), Cuba (6%), Philippines (5%) are the major countries having reserves of Nickel. The identified land-based resources with an average of 1% nickel or more are about 130 million tonnes. About 60% of nickel reserves is in laterites and 40% in sulphide deposits. Extensive nickel resources are also found in manganese crusts and as nodules in the ocean floor (Table-2).

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

(In '000 tonnes of nickel content)

Country	Reserves
World: Total (rounded off)	**89000**
Australia	19000
Brazil	11000
Canada	2700
China	2800
Colombia	440
Cuba	5500
Guatemala	1800
Indonesia	21000
Madagascar	1600S
New Caledonia	-
Philippines	4800
Russia	7600
South Africa	3700
USA	110
Other countries	6500

***Source**: Mineral Commodity Summaries,2019*

In 2017, world mine production of nickel increased to 2.09 million tonnes as compared to 1.91 million tonnes of metal content in the previous year (Table-3).

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

(In '000 tonnes of metal content)

Country	2015	2016	2017
World Total	**2078**	**1917**	**2098**
Australia	229	203	178
Botswana	16	14	-
Brazil	89	78	87
Canada	234	235	214
China	101	100	105
Colombia	36	37	40
Cuba	53	51	52
Finland[a]	9	20	34
Greece	20	21	19
Guatemala	46	36	54
Other countries	1346	1122	1367

***Source**: World Mineral Production, 2013-17*
a: In addition some nickel is produced as a by-product of a talc operation. The amount is negligible

FOREIGN TRADE

Exports

Exports of nickel ores and concentrates were meager quantity in the year 2017-18. On the other hand exports of nickel and alloys including waste & scrap decreased sharply to 2,799 tonnes in 2017-18 from 8,708 tonnes in the previous year. Out of the total alloys and scrap exported in 2017-18, nickel & alloys were 2,262 tonnes, while nickel waste & scrap were 537 tonnes. Exports were mainly to China, UK, Singapore, Japan and USA (Tables-4 to 7).

Imports

Imports of nickel ores & concentrates were not reported in the year 2017-18. However, imports of nickel ores & concentrates in the year 2016-17 were 1,062 tonnes. Imports of nickel & alloys including scrap were 62,259 tonnes in 2017-18 as compared to 49,539 tonnes in the previous year. Out of total alloys and scrap imported in 2017-18, nickel & alloys was 58,521 tonnes as compared to 46,878 tonnes in the previous year, while nickel waste & scrap were 3,738 tonnes as compared to 2,661 tonnes in the previous year. Imports of nickel and alloys including scrap in 2017-18 were mainly from Papua New Guinea, Australia, Norway, Russia and South Africa (Tables-8 to 11).

Table – 4 : Exports of Nickel Ores and Conc. (By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	-	-	++	**19**
USA	-	-	++	18
UK	-	-	++	1

Table – 5 : Exports of Nickel and Alloys Including Scrap (By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**8708**	**6115822**	**2799**	**2730937**
China	3436	2523827	479	355962
USA	165	199677	266	341088
UK	179	110865	372	239607
Singapore	11	25114	296	226040
Saudi Arabia	56	138586	70	205297
Japan	346	209780	281	177345
UAE	809	529932	97	128284
Mexico	44	44626	79	81662
Thailand	76	85274	68	75739
Netherlands	67	61748	96	75367
Other countries	3519	2186393	695	824546

Table – 6 : Exports of Nickel & Alloys
(By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**8301**	**5973202**	**2262**	**2481832**
China	3436	2523827	479	355962
USA	147	190047	197	298580
Singapore	11	25114	262	207689
Saudi Arabia	56	138586	70	205297
Japan	248	173425	196	143442
UK	40	50816	148	132108
UAE	809	529932	97	128284
Mexico	44	44626	79	81662
Thailand	76	85274	68	75739
Iran	78	90188	45	72177
Other countries	3356	212367	621	780892

Table – 7 : Exports of Nickel Waste & Scrap
(By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**407**	**142620**	**537**	**249105**
UK	139	60049	224	107499
USA	18	9630	69	42508
Japan	98	36355	85	33903
Singapore	-	-	34	18351
Netherlands	-	-	55	18190
Germany	152	36586	47	16128
Korea, Rep. of	-	-	12	6987
Malaysia	-	-	10	5218
Sri Lanka	-	-	1	180
Nepal	-	-	++	141
Other countries	-	-	-	-

Table –8 : Imports of Nickel Ores & Conc.
(By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**1062**	**818094**	-	-
Guinea	796	621980	-	-
Australia	264	195333	-	-
Belgium	2	759	-	-
Finland	++	22	-	-

Table – 9 : Imports of Nickel and Alloys Including Scrap
(By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**49539**	**37077252**	**62259**	**40778023**
Australia	5920	3984985	10501	7528424
Norway	6088	4204345	7745	5767029
Russia	7165	4699826	5607	3958485
South Africa	4056	2768142	4305	3042651
Canada	4708	3325701	3623	2810946
USA	1567	1966810	1711	2433547
Japan	3125	2436489	2682	2315139
UK	1984	2058868	2042	2277453
Papua New Guinea	-	-	13786	2054289
China	572	730167	1226	1335982
Other countries	14354	10901919	9031	7254078

Table – 10 : Imports of Nickel & Alloys (By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**46878**	**35988099**	**58521**	**39217134**
Australia	5853	3961631	10500	7528064
Norway	6088	4204345	7745	5767029
Russia	7165	4699826	5564	3942798
South Africa	4056	2768142	4305	3042651
Canada	4708	3325701	3623	2810946
Japan	3125	2436489	2682	2315139
UK	1884	2019728	1881	2202238
USA	1089	1764254	1066	2175517
Papua New Guinea	-	-	13786	2054289
China	572	730167	1226	1335982
Other countries	12338	10077816	6143	6042481

Table – 11 : Imports of Nickel Waste & Scrap (By Countries)

Country	2016-17		2017-18 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	**2661**	**1089153**	**3738**	**1560889**
Saudi Arabia	563	210581	991	392339
UAE	790	321749	684	286169
USA	478	202556	645	258030
Bangladesh	117	48579	443	200015
Kuwait	101	49970	304	132191
UK	100	39140	161	75215
Malaysia	59	27152	79	47150
Singapore	-	-	84	34215
Italy	15	7282	59	25804
Lithuania	-	-	40	16378
Other countries	438	182144	248	93383

FUTURE OUTLOOK

Primarily World nickel demand is for the production of stainless steel where about 65% nickel is consumed. 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. Batteries and the ongoing Electric Vehicle revolution could prove to be a transformational event as NCA and NCM. Li-ion technology establishes itself as the battery chemistry of choice and EV penetration multiplies from a non-existent base.

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.

The process developed by HCL for the production of primary nickel from waste generated during copper refining will be a breakthrough in the area of nickel production in the country.

India imports as well as exports nickel scrap covered by ISRI code, Aroma, Barly, Dandy, Daunt, Delta, Decov, Depth, Hitch, House, Ideal, Indian, Junto, Lemon, Lemur are covered under HS code 75030010. But there is hardly any data available for recycling and recovery of nickel from scrap. The recycling of nickel-bearing scrap in Organised Sector will be another source for meeting the demand.