

ANTIMONY



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ANTIMONY

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**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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2 Antimony

Antimony is a strategic metal. The predominant ore of antimony is stibnite composed of antimony trisulphide, Sb_2S_3 (Sb 71.4%). The other important ores of antimony are jamesonite ($Pb_2Sb_2S_5$) and senarmonite/valentinite (Sb_2O_3). Antimony in its elemental form is a silvery white, brittle, fusible, crystalline solid that exhibits poor electrical and heat conductivity properties and vaporises at low temperatures. Antimony and some of its alloys exhibit unusual property of expansion on cooling. Commercial forms of antimony are generally traded in the form of ingots, broken pieces, granules or cast cake. Other forms are powder, shots and single crystals. Occurrence of antimony in the earth crust ranges from 0.2 to 0.5 parts per million. Antimony is geochemically categorised as a chalcophile, occurring with sulphur and associated with heavy metals, such as, lead, copper and silver.

RESERVES/RESOURCES

As per the NMI database based on UNFC system, as on 1.4.2015, the total reserves/resources of antimony has been estimated at 10,588 thousand tonnes. The ore with metal content is placed at 174 thousand tonnes, all in Inferred category located in Lahaul & Spiti district, Himachal Pradesh (Table-1).

The stibnite and its decomposition products, cervantite and kermesite occur as veins, stringers and specks. Occurrences of antimony ores are also reported from the States of Andhra Pradesh, Jharkhand, Karnataka, Uttarakhand and Union Territory of Jammu & Kashmir.

USES

Antimony and its alloys find numerous applications in a wide range of high technology industries like electronic, space defence, photographic materials, electroplating, besides cosmetic, paint, plastics and textile industries. Traditionally, it is used in type metal in Printing

Industry and other alloys. It is now used extensively worldwide to harden and increase the mechanical strength of lead, particularly in Battery Industry. Antimony trioxide is the most important of the antimony compounds and is primarily used in flame-retardant applications, including such markets, as children's clothing, toys as well as in manufacturing aircraft and automobile seat covers. Antimony sulphide is one of the ingredients used in safety matches. It is used in solar panels to improve stability of the solar performance of the glass upon exposure to UV radiations or sunlight and also as a decolourising and refining agent in Glass Industry. Antimony compounds also find use in pharmaceutical applications. It is also used in semiconductors for making infrared detectors, diodes & acoustic devices, and in plastic production as a heat stabiliser in PVC.

INDUSTRY

The metal is obtained commonly as a by-product in lead-zinc-silver smelting. As part of its R & D programme, HZL successfully implemented antimony dust treatment flow sheet at Ancillary Industry. Antimony dust at Pantnagar Metal Plant (PMP) was leached in controlled conditions to recover antimony as Potassium Antimony Tartarate (PAT) reagent which is used in Zinc Hydro plants purification section and enriched lead silver residue. Presently, there is no production of antimony in India. The entire requirement of antimony in the country is met through imports of its ore and concentrates. HZL is currently operating metal plant having 1,400 TPA antimony concentrate (by-product). During 2018-19, HZL produced 800 million tonne of antimony slag consisting of 60% lead and 20% antimony from pyro-smelter plant. The antimony slag is recovered as antimony trioxide with more than 95% purity, which is commercially accepted with high demand as flame retardant.

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**Table – 1 : Reserves/Resources of Antimony as on 1.4.2015
(By Grades/State)**

(In '000 tonnes)

Grade/State	Reserves			Remaining Resources				Total Resources (A+B)		
	Proved STD111	Probable STD121 STD122	Total (A)	Feasibility STD211	Pre-feasibility STD221 STD222	Measured STD331	Indicated STD332		Inferred STD333	Reconnaissance STD334
All India : Total	-	-	-	-	-	-	-	10588	-	10588
Ore	-	-	-	-	-	-	-	174	-	174
Metal	-	-	-	-	-	-	-	-	-	-
By State										
Himachal Pradesh										
Ore	-	-	-	-	-	-	-	10588	-	10588
Metal	-	-	-	-	-	-	-	174	-	174

Figures rounded off

SUBSTITUTES

Combination of tin, calcium, copper, selenium, cadmium, strontium and sulphur is among the substitutes used as hardeners for lead used in batteries. Low maintenance batteries have started using calcium as additive to substitute antimony. Antimony can be replaced by organic compounds or hydrated aluminium oxide in flame-retardants and by tellurium and selenium in rubber manufacturing. Compounds of titanium, zinc, chromium, tin and zirconium are substituted for antimony chemicals in paints, pigments and enamels.

TECHNICAL POSSIBILITIES

Antimony products can be used as stabilisers in specialised plastics. Development of electric vehicles could lead to the use of high antimonial lead batteries because of their deep cycling characteristics. Antimony semiconductors have possible use in aircraft night vision systems and in space-based astronomy. Antimony has also been found to be used in the manufacture of DVDs.

RECYCLING

Traditionally, the bulk of secondary antimony has been recovered at secondary lead smelters as antimonial lead, most of which was generated and then consumed by the Lead-acid Battery Industry.

WORLD REVIEW

The world reserves of antimony were 1.9 million tonnes in terms of metal content. Antimony reserves are located mainly in China, which contributes about 25% of the total reserves followed by Russia (18%), Bolivia (16%), Kyrgyzstan (14%), Australia (7%), Turkey (5%), Canada (4%) and USA (3%) (Table-2).

The world mine production of antimony metal decreased by 26% to 1,29,000 tonnes in 2019 as against 1,74,000 tonnes in the previous year. China with (47%) production was the main producer of antimony in the world followed by Tajikistan (23%), Russia (17%) and Myanmar (4%) (Table-3).

China continued to be the leading antimony producing country in the world. The Chinese Government considered antimony to be one of the protected and strategic minerals and therefore strictly controlled the exploitation and production of antimony. In Oman, construction of an antimony

smelter with 20,000 tonnes per year capacity of antimony metal and antimony oxide was initiated after acquisition of funds and other developmental proceedings put into place.

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

(In tonnes of metal content)	
Country	Reserves
World : Total (rounded off)	190000
Australia	140000 ^(b)
Bolivia	310000
Myanmar	NA
Canada	78000
China	480000
Ecuador	NA
Guatemala	NA
Iran	NA
Kazakhstan	NA
Kyrgyzstan	260000
Laos	NA
Mexico	18000
Pakistan	26000
Russia (recoverable)	350000
Tajikistan	50000
Turkey	100000
USA	60000 ^(a)
Vietnam	NA

Source: USGS, Mineral Commodity Summaries, 2021

NA - Not available

(a) Company-reported probable reserves for the Stibnite Gold Project in Idaho.

(b) For Australia, Joint Ore Reserves committee-compliant reserves were 64,600 tonnes.

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

(In tonnes of metal content)			
Country	2017	2018	2019
World: Total (rounded off)	162000	174000	129000
China	97683	95286	60229
Tajikistan	26450	28881	29898
Russia	14400	30828	21671
Myanmar ^(e)	7000	5400	5000
Turkey	4750	3500	3500 ^(e)
Bolivia	2881	3110	2747
Iran ^(f)	2489	2551	2500 ^(e)
Australia ^(e)	4294	2866	2170
Vietnam	230	244	306
Other countries	2141	1045	550

Source: BGS, World Mineral Production, 2015-19

(c) Years ended 30 June of that stated.

(j) Years ended 31 March following that stated

FOREIGN TRADE

Exports

Exports of antimony ores & concentrates was nil in 2019-20 as compared to negligible in the previous year.

Exports of antimony alloys and scrap decreased slightly by 3 % to 2,218 tonnes in 2019-20 as against 2,282 tonnes in the previous year. Exports were mainly to USA (75%), Italy (5%), Pakistan (4%), Canada (3%) and Netherlands, South Africa & Brazil (2% each). Exports of antimony (Unwrought) powders also decreased to 2,206 tonnes in 2019-20 as against 2,270 tonnes in 2018-19. Exports of antimonial lead were at 14,200 tonnes in 2019-20 as compared to 11,095 tonnes in 2018-19 (Tables- 4 to 8).

Imports

Imports of antimony ores and concentrates increased marginally by 2% to 7,655 tonnes in 2019-20 as compared to 7,496 tonnes in the previous year. Imports were mainly from Russia (82%), China (13%), USA (4%) and remaining one per cent was contributed by other countries.

Imports of antimony alloys and scrap increased substantially by 24% to 1,465 tonnes in 2019-20 from 1,177 tonnes in the previous year. Imports of alloys and scrap were mainly from China (65%), Thailand (10%), Singapore (8%), Hong Kong (6%), UK & Vietnam (3% each) and Netherlands & USA (2% each). Imports of antimony (Unwrought) powders increased by 24% to 1,456 tonnes in 2019-20 as compared to 1,175 tonnes in the preceding year. Imports were mainly from China (65%), Thailand (10%), Singapore (8%), Hong Kong (6%), UK & Vietnam (3% each) and Netherlands & UAE (2% each). (Tables-9 to 13).

**Table – 4 : Exports of Antimony Ores & Conc.
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	++	7	-	-
Japan	++	4	-	-
Canada	++	2	-	-

Figures rounded off

**Table – 5 : Exports of Antimony (Unwrought)
Powders
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	2270	1234685	2206	919912
USA	1726	925819	1657	682716
Italy	-	-	116	46154
Pakistan	393	221333	97	43463
Canada	20	10428	73	28925
Netherlands	72	43099	49	24526
South Africa	25	13143	51	22285
Brazil	-	-	42	17589
UAE	6	3269	26	11765
Turkey	-	-	25	9807
Spain	-	-	24	9764
Other countries	29	17593	48	22918

Figures rounded off

**Table – 6 : Exports of Antimony & Articles, NES
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	12	8189	12	7463
Sri Lanka	++	24	9	5482
Kenya	++	54	2	821
Germany	1	1032	++	514
Uganda	++	78	1	462
France	-	-	++	105
Nepal	11	6956	++	54
Korea, Rep. of	-	-	++	17
Bhutan	-	-	++	5
Zambia	-	-	++	4
Afghanistan	++	3	-	-
Other countries	++	41	-	-

Figures rounded off

**Table – 7: Exports of Antimony Alloys & Scrap
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	2282	1242874	2218	927375
USA	1726	925819	1657	682716
Italy	-	-	116	46154
Pakistan	393	221333	97	43463
Canada	20	10428	73	28925
Netherlands	72	43099	49	24526
South Africa	25	13143	51	22285
Brazil	-	-	42	17589
UAE	6	3269	26	11765
Turkey	-	-	25	9807
Spain	-	-	24	9764
Other countries	41	25782	60	30381

Figures rounded off

**Table – 8 : Exports of Antimonial Lead
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	11095	1805326	14200	2159294
UAE	2650	423626	3046	463801
Bangladesh	551	95098	3073	460895
Vietnam	1525	255338	2128	331542
Japan	1239	204053	1572	240298
Oman	695	102730	1487	219695
Korea, Rep. of	2476	407410	1402	206320
Nepal	297	51029	415	64630
USA	221	36549	284	46523
Indonesia	1298	204934	275	43447
Spain	-	-	157	23676
Other countries	144	24557	362	58468

Figures rounded off

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**Table – 9 : Imports of Antimony Ores & Conc.
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	7496	1609648	7655	1265983
Russia	4575	905400	6273	1014285
China	387	105991	958	154931
USA	-	-	269	52025
Italy	88	43039	49	23002
Canada	-	-	57	10971
Myanmar	144	31551	50	10769
Tajikistan	1289	298693	-	-
Br Virgin Isl	965	217150	-	-
Belgium	25	5124	-	-
Bolivia	23	2686	-	-
Other countries	++	15	-	-

Figures rounded off

**Table – 10 : Imports of Antimonial Lead
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	10319	1628008	20151	2995865
Korea, Rep. of	3900	636385	6973	1086005
Malaysia	445	69526	6204	897235
UAE	3217	496476	3008	434964
Singapore	412	62149	945	139290
Chile	662	97906	674	92403
Tanzania	420	67927	512	73778
Germany	48	7963	415	63641
UK	20	3745	321	46777
Saudi Arabia	-	-	296	42198
Nigeria	-	-	203	30467
Other countries	1195	185932	599	89108

Figures rounded off

**Table – 11 : Imports of Antimony & Articles, NES
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	++	375	9	5482
China	-	-	9	4401
USA	++	194	++	1065
Germany	++	72	++	16
France	++	82	-	-
UK	++	27	-	-

Figures rounded off

**Table – 12 : Imports of Antimony (Unwrought), Powders
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	1175	670281	1456	654784
China	277	155275	948	431246
Thailand	45	27079	147	68820
Singapore	369	215218	123	51249
Hong Kong	41	22180	94	41148
UK	31	16208	48	21240
Vietnam	277	158657	46	18606
Netherlands	-	-	25	11134
UAE	-	-	25	10344
France	-	-	++	941
USA	++	28	++	54
Other countries	134	75634	++	3

Figures rounded off

**Table – 13 : Imports of Antimony Alloys & Scrap
(By Countries)**

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	1177	673155	1465	660698
China	277	155275	957	435647
Thailand	45	27079	147	68820
Singapore	369	215218	123	51249
Hong Kong	41	22180	94	41148
UK	33	18735	48	21672
Vietnam	277	158657	46	18606
Netherlands	-	-	25	11134
UAE	-	-	25	10344
USA	++	223	++	1119
France	++	82	++	941
Other countries	134	75706	++	18

Figures rounded off

FUTURE OUTLOOK

The future growth in demand for antimony will be much dependent on the level of requirement from the Flame-retardant Sector which accounts for about 48% primary antimony consumption worldwide and for about 90% global antimony trioxide consumption.

In the Flame-retardant Sector, antimony trioxide is used as a synergist normally with bromine and chlorine. Currently, antimony-based catalysts account for around 90% usage worldwide in polyethylene terephthalate (PET) production.

A new chip, based on germanium-antimony-telluride was developed abroad for 'Phas e-change' Random Access Memory chips (PRAMS) which can process data faster than flash memory chips and unlike silicon are non-flammable. The chips have been commercialised and are expected to find

applications in mobile phones and digital cameras. In contrast, antimony metal consumption in metallurgical and battery markets could show a declining trend. The recent research and development programmes initiated by lead-acid battery manufacturers have led to significant changes in lead-acid battery design that have yielded substantial performance improvement which is bound to make lead-acid batteries a better and viable option as compared to its counterparts. This would eventually result in reduced use of antimony in lead-acid batteries diminishing the prospect of use of antimony in Battery Markets. The world supplies of antimony are expected to rise to an extent sufficient enough to meet the prospective demand. However, as per USGS, global consumption of antimony is expected to increase owing to projected increase in the use of antimony in flame retardants, lead-acid batteries and plastics, primarily in Asia.