

ANTIMONY



# Indian Minerals Yearbook 2022

(Part-II Metals and Alloys)

61<sup>st</sup> Edition

**ANTIMONY**

**(ADVANCE RELEASE)**

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

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## 2 Antimony

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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 1.4.2020, the total reserves/resources of antimony has been estimated at 18,683 thousand tonnes. The ore with metal content is placed at 255 thousand tonnes, Inferred category located in Lahaul & Spiti district, Himachal Pradesh (68%) and Madhya Pradesh (32%)(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). The antimony slag is recovered as antimony trioxide with more than 95% purity, which is commercially accepted with high demand as flame retardant.

**Table – 1 : Reserves/Resources of Antimony as on 1.4.2020  
(By Grades/States)**

(In '000 tonnes)

Grade/State	Reserves			Remaining Resources					Total Resources (A+B)		
	Proved STD111	Probable STD121	Total (A) STD122	Feasibility STD211	Pre-feasibility STD221	Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	Total (B)
<b>All India : Total</b>	-	<b>7503</b>	<b>7503</b>	-	-	-	-	<b>10588</b>	-	<b>11180</b>	<b>18683</b>
Ore	-	75	75	-	-	5.92	-	174	-	179.92	254.92
Metal	-	-	-	-	-	-	-	-	-	-	-
<b>By State</b>											
Himachal Pradesh											
Ore	-	-	-	-	-	-	-	10588	-	10588	10588
Metal	-	-	-	-	-	-	-	174	-	174	174
Madhya Pradesh											
Ore	-	7503	7503	-	-	5.92	-	-	-	592	8095
Metals	-	75	75	-	-	5.92	-	-	-	5.92	80.92

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*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 1.8 million tonnes in terms of metal content. Antimony reserves are located mainly in China and Russia which contributes about 19% each of the total reserves followed by Bolivia (17%), Kyrgyzstan (14%), Australia (7%), (Table-2).

The world mine production of antimony metal decreased by 23% to 91,000 tonnes in 2021 as against 1,19,000 tonnes in the previous year. China with (47%) production was the main producer of antimony in the world followed by Tajikistan (22%), Russia (10%) and Iran (5%) (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
<b>World : Total (rounded off)</b>	<b>1,800,000</b>
China	350,000
Russia (recoverable)	350,000
Bolivia	310,000
Kyrgyzstan	260,000
Myanmar	140,000
Australia	<sup>(b)</sup> 120,000
Turkey	100,000
Canada	78,000
Tajikistan	50,000
United States	<sup>(a)</sup> 60,000
Pakistan	26,000
Mexico	18,000

*Source: USGS, Mineral Commodity Summaries, 2023*

*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 18000 tonnes.*

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

(In tonnes of metal content)			
Country	2019	2020	2021
<b>World: Total (rounded off)</b>	<b>132000</b>	<b>119000</b>	<b>91000</b>
China	60229	60995	42622
Tajikistan	29898	22500	20000
Russia	21671	17532	9000
Iran <sup>(j)</sup>	5264	5006	5000
Turkey	3810	2570	4210
Australia <sup>(c)</sup>	2170	3903	3380
Mexico	290	136	413
Bolivia	2747	2629	3084
Myanmar <sup>(c)</sup>	5000	3800	2300
Vietnam	395	312	305
Laos	70	-	242
Other countries	196	49	205

*Source: BGS, World Mineral Production, 2017-21*

*(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 for the years 2021-22 and 2020-21.

Exports of antimony alloys and scrap decreased slightly by 11 % to 1918 tonnes in 2021-22 as against 2134 tonnes in the previous year. Exports were mainly to USA (84%), Brazil (5%) and UAE. Exports of antimony (Unwrought) powders also decreased to 1916 tonnes in 2021-22 as against 2130 tonnes in 2020-21. Exports of antimonial lead were at 22633 tonnes in 2021-22 as compared to 15839 tonnes in 2020-21 (Tables- 4 to 7).

## Imports

Imports of antimony ores and concentrates decreased by 24% to 4555 tonnes in 2021-22 as compared to 5977 tonnes in the previous year. Imports were mainly from Tajikistan (53%), Russia (22%), Canada (17% each).

Imports of antimony alloys and scrap decreased substantially by 11% to 1173 tonnes in 2021-22 from 1319 tonnes in the previous year. Imports of alloys and scrap were mainly from Oman (36%), China (34%) and Vietnam (14%). Imports of antimony (Unwrought) powders decreased by 11% to 1162 tonnes in 2021-22 as compared to 1298 tonnes in the preceding year. Imports were mainly from Oman (36%), China (34%), Vietnam (13%) and Thailand (10%) (Tables-7 to 12).

**Table – 4 : Exports of Antimony (Unwrought) Powders (By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>2130</b>	<b>930744</b>	<b>1916</b>	<b>1507015</b>
USA	1679	716907	1627	1271920
Brazil	84	46566	111	98654
UAE	73	34572	75	56118
Bangladesh	17	7530	38	33305
South Africa	-	-	35	27188
Vietnam	-	-	20	9077
Sri Lanka	7	3727	6	6132
Nepal	++	15	2	2123
Netherlands	69	32042	1	1115
Nigeria	3	1527	1	1033
Other Countries	198	87858	++	350

Figures rounded off

**Table – 5 : Exports of Antimony & Articles, NES (By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>4</b>	<b>2178</b>	<b>2</b>	<b>973</b>
Nepal	3	1267	1	662
Australia	-	-	1	259
Rwanda	-	-	++	22
Baharain	-	-	++	21
Bangladesh	-	-	++	9
Maldives	-	-	++	++
Uganda	1	657	-	-
Sudan	++	225	-	-
UAE	++	15	-	-
Bhutan	++	8	-	-
Other countries	++	6	-	-

Figures rounded off

**Table – 6 : Exports of Antimony Alloys & Scrap (By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>2134</b>	<b>932922</b>	<b>1918</b>	<b>1507988</b>
USA	1679	716907	1627	1271920
Brazil	84	46566	111	98654
UAE	73	34587	75	56118
Bangladesh	17	7530	38	33314
South Africa	-	-	35	27188
Vietnam	-	-	20	9077
Sri Lanka	7	3727	6	6132
Nepal	3	1282	3	2785
Netherlands	69	32042	1	1115
Nigeria	3	1527	1	1033
Other countries	199	88754	1	652

Figures rounded off

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**Table – 7 : Exports of Antimonial Lead  
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>15839</b>	<b>2395362</b>	<b>22633</b>	<b>4087251</b>
Korea, Rep. of	1120	176475	8769	1602541
UAE	4102	619059	4410	777971
Vietnam	1421	213221	3032	538127
Bangladesh	6084	905373	2280	400045
Japan	842	126448	983	177169
Singapore	100	15582	727	126085
Oman	852	126136	647	110721
Thailand	-	-	409	90888
Nepal	383	60365	465	85049
USA	548	90144	268	51966
Other countries	387	62559	643	126689

*Figures rounded off*

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

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>5977</b>	<b>1072406</b>	<b>4555</b>	<b>1499919</b>
Tajikistan	249	51502	2430	781446
Canada	1133	207763	777	322490
Russia	3355	583767	996	257428
Chile	-	-	131	58262
Italy	25	10941	79	38211
USA	-	-	61	24669
Kazakhstan	-	-	81	17413
China	1155	207247	-	-
Myanmar	60	11181	-	-
Thailand	++	5	-	-

*Figures rounded off*

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**Table – 9 : Imports of Antimonial Lead  
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>30477</b>	<b>4523873</b>	<b>32305</b>	<b>5657916</b>
Malaysia	11878	1703491	13304	2289306
Korea, Rep. of	5553	848224	8086	1472811
Singapore	5194	770024	6217	1087677
UAE	2459	368954	1188	218727
Saudi Arabia	2002	306045	1096	171853
Vietnam	-	-	600	106264
Germany	98	13950	404	66736
Thailand	499	78370	353	61923
Luxembourg	224	32847	319	58129
UK	-	-	197	33824
Other countries	2570	401968	541	90666

*Figures rounded off***Table – 10 : Imports of Antimony & Articles, NES  
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>21</b>	<b>10067</b>	<b>11</b>	<b>9341</b>
Vietnam	21	9368	10	7739
Japan	-	-	1	1188
UK	++	224	++	379
USA	++	414	++	35
Germany	++	61	-	-

*Figures rounded off***Table – 11 : Imports of Antimony (Unwrought), Powders  
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>1298</b>	<b>581296</b>	<b>1162</b>	<b>988906</b>
Oman	58	23937	420	377739
China	693	320171	402	328961
Vietnam	134	62034	155	118749
Thailand	77	33425	123	107106
Netherlands	124	55557	23	22984
Sweden	-	-	24	18904
UK	25	9953	15	14460
USA	++	40	++	3
Singapore	93	39818	-	-
Myanmar	24	10307	-	-
Other countries	70	26054	-	-

*Figures rounded off*

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**Table – 12 : Imports of Antimony Alloys & Scrap  
(By Countries)**

Country	2020-21 (R)		2021-22 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
<b>All Countries</b>	<b>1319</b>	<b>591363</b>	<b>1173</b>	<b>998247</b>
Oman	58	23937	420	377739
China	693	320171	402	328961
Vietnam	155	71402	165	126488
Thailand	77	33425	123	107106
Netherlands	124	55557	23	22984
Swedan	-	-	24	18904
UK	25	10177	15	14839
Japan	25	10303	1	1188
USA	++	454	++	38
Singapore	93	39818	-	-
Other countries	69	26119	-	-

*Figures rounded off*

## FUTURE OUTLOOK

Antimony in a list of 30 critical minerals for India, released by Ministry of Mines, Government of India on 24.07.2023. 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. Antimony is a versatile element with a range of industrial application, although its use has become more regulated due to concern about its environmental and health impacts.