

ANTIMONY



# Indian Minerals Yearbook 2017

(Part- II : Metals & Alloys)

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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

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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. The 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. 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 flowsheet 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.

### RESOURCES

As per the NMI database, based on UNFC system, as on 1.4.2015, total reserves/ resources of antimony have been estimated at 10,588 tonnes, ore with metal content of 174 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, Jammu & Kashmir, Jharkhand, Karnataka and Uttarakhand.

### 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 of safety matches. It is also used as a decolourising and refining agent in Glass Industry. Antimony compounds also find use in pharmaceutical applications. It is also used in semi-conductors for making infrared detectors, diodes and acoustic devices.

### SUBSTITUTES

Combination of tin, calcium, copper, selenium, cadmium, strontium and sulphur are 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.

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

(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
<b>All India : Total</b>	-	-	-	-	-	-	-	<b>10588</b>	-	<b>10588</b>
<b>Ore</b>	-	-	-	-	-	-	-	<b>174</b>	-	<b>174</b>
<b>Metal</b>	-	-	-	-	-	-	-	-	-	-
<b>By States</b>										
Himachal Pradesh										
Ore	-	-	-	-	-	-	-	10588	-	10588
Metal	-	-	-	-	-	-	-	174	-	174

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*Figures rounded off.*

## 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 1.5 million tonnes in terms of metal content. Antimony reserves are located mainly in China, which contributes about 32% of the total reserves followed by Russia (23%), Bolivia (21%), Australia (9%), USA (4%), Turkey (7%) & Tajikistan (3%) (Table-2).

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

(In tonnes of metal content)	
Country	Reserves
<b>World : Total (rounded)</b>	<b>1500000</b>
Australia	140000
Bolivia	310000
China	480000
Mexico	18000
Russia (Recoverable)	350000
South Africa	27000
Tajikistan	50000
USA	60000
Turkey	100000

*Source: Mineral Commodity Summaries, 2018.*

The world production of antimony metal decreased drastically by 18% to 1,42,918 tonnes in 2015 as against 1,74,592 tonnes in the previous year. China with 78% production was the main producer of antimony in the world followed by Russia (5%), Tajikistan (4%) and Bolivia & Australia 3 percent each (Table-3).

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

(In tonnes of metal content)

Country	2013	2014	2015
<b>World : Total</b>	<b>193312</b>	<b>174592</b>	<b>142918</b>
Australia	2883	3484	3737
Bolivia	5053	4186	3843
Myanmar	7400	3300	3000
Canada	177	5	1
China	152104	140389	111400
Guatemala	159	-	-
Iran	400	432	400 <sup>e</sup>
Kazakhstan	900	800	700
Kyrgyzstan <sup>e</sup>	900	2450	2000
Laos	804	620	1100
Mexico	294	266	90
Pakistan	89	127	114
Russia	6520	6400 <sup>e</sup>	7420
South Africa	2332	816	100 <sup>e</sup>
Tajikistan	7307	6500	5400 <sup>e</sup>
Thailand	488	706	700 <sup>e</sup>
Turkey	4512	3013	1917
Vietnam	990	1098	996

*Source: World Mineral Production, 2011-2015.*

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, a producer, which planned to construct an antimony smelter with 20,000 tonnes per year capacity of antimony metal and antimony oxide, acquired adequate funding and was proceeding with development. The Flame-retardant Sector was the leading consumer of antimony and accounted for about 50% of the total resources followed by battery alloys, (17%), plastic stabilisers, (15%), glass (10%) and others 8 percent.

## FOREIGN TRADE

### Exports

During 2016-17, exports of antimony ores & concentrates were at 46 tonnes. Exports were mainly to Austria (100%). Exports of antimony ores & concentrates were at 264 tonnes during 2015-16. Exports were mainly to China & Austria (45% each) as against the nil quantity reported during 2014-15. Exports of antimony (Unwrought) powders were 2,031 tonnes in 2015-16 as against 2,325 tonnes in 2014-15. Exports were mainly to USA (60%) followed by Pakistan (16%) and Netherlands (11%).

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**Table- 4: Exports of Antimony: Ore & Conc.  
(By Countries)**

Country	2016-17 (P)	
	Quantity (t)	Value (₹'000)
<b>All Countries</b>	<b>46</b>	<b>9646</b>
Austria	46	9636
Other countries	++	10

Source: Import-Export data bank, Ministry of Commerce,  
HS Code-26171000

**Table – 5 : Exports of Antimony Ores & Conc.  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	-	-	<b>264</b>	<b>115561</b>
China	-	-	120	85854
Austria	-	-	120	24185
Italy	-	-	24	5522

**Table – 6 : Exports of Antimony (Unwrought), Powders  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>2325</b>	<b>1208372</b>	<b>2031</b>	<b>838692</b>
USA	1185	599815	1214	498767
Pakistan	539	291838	321	133729
Netherlands	116	57832	215	89805
Japan	70	38235	80	32059
Bangladesh	-	-	50	19505
Turkey	-	-	46	14810
South Africa	-	-	25	10877
UAE	51	27378	20	10625
Egypt	-	-	20	8996
Lebanon	-	-	22	8222
Other countries	364	193274	18	11297

**Table – 7 : Exports of Antimony & Articles, NES  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>46</b>	<b>1391</b>	<b>3</b>	<b>2212</b>
Saudi Arabia	-	-	1	1213
Germany	-	-	++	691
Oman	-	-	1	181
Bangladesh	46	1249	1	126
Nepal	++	142	-	-
Other countries	-	-	++	1

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**Table – 8: Exports of Antimony Alloys & Scrap  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>2371</b>	<b>1209763</b>	<b>2034</b>	<b>840904</b>
USA	1185	599815	1214	498767
Pakistan	539	291838	321	133729
Netherlands	116	57832	215	89805
Japan	70	38235	80	32059
Bangladesh	46	1249	51	19631
Turkey	-	-	46	14810
South Africa	-	-	25	10877
UAE	51	27378	20	10625
Egypt	-	-	20	8996
Lebanon	-	-	22	8222
Other countries	364	193416	20	13383

**Table- 10: Imports of Antimony: Ore & Conc.  
(By Countries)  
2016-17(P)**

Country	2016-17 (P)	
	Quantity (t)	Values (₹'000)
<b>All Countries</b>	<b>4756</b>	<b>752103</b>
Tajikistan	2612	483535
Kazakhstan	1618	165880
Russia	286	41470
Italy	90	36440
Turkey	80	15186
Thailand	70	9592

*Source: Import-Export data bank, Ministry of Commerce, HS  
Code-26171000*

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

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>10628</b>	<b>1452384</b>	<b>4960</b>	<b>655652</b>
Korea, Rep. of	5667	778813	2476	339547
Oman	1312	176910	468	56752
Cuba	630	81671	435	55562
Bangladesh	1737	233188	362	46684
UAE	50	6683	371	46448
Nepal	214	29985	241	31240
Indonesia	98	13126	124	15396
Korea, Dem. Peop. Rep.	129	17629	116	15006
Spain	-	-	101	12951
Estonia	-	-	51	7260
Other countries	791	114379	215	28806

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**Table – 11 : Imports of Antimony Ores & Conc.  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>4711</b>	<b>1004076</b>	<b>5330</b>	<b>924221</b>
Tajikistan	1403	272361	3403	631163
Australia	1641	321493	1326	177254
Kazakhstan	-	-	373	36288
Myanmar	100	39503	100	35911
Italy	88	46139	68	32480
Turkey	-	-	60	11068
Austria	261	60253	++	57
South Africa	1134	249965	-	-
Bolivia	84	14352	-	-
Iran	++	10	-	-

**Table – 12 : Imports of Antimonial Lead  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>4959</b>	<b>695252</b>	<b>4385</b>	<b>554014</b>
Korea, Rep.of	2557	360099	2893	380840
UAE	675	91399	902	103498
Malaysia	463	68299	215	25231
Vietnam	249	32332	100	11692
Ghana	-	-	99	11012
Australia	411	58355	83	10531
Nigeria	-	-	53	6293
Mexico	-	-	40	4917
Israel	291	41600	-	-
Korea, Dem. Peop. Rep.	149	21013	-	-
Other countries	164	22155	-	-

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**Table – 13 : Imports of Antimony & Articles, NES  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>10</b>	<b>6597</b>	<b>++</b>	<b>376</b>
Japan	-	-	++	211
US	++	246	++	118
Germany	++	89	++	28
UK	++	48	++	19
China	10	6144	-	-
France	++	70	-	-

**Table – 14 : Imports of Antimony (Unwrought), Powders  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>1014</b>	<b>577289</b>	<b>1163</b>	<b>519869</b>
China	736	418524	983	439554
Japan	51	27089	89	39032
Thailand	91	52170	30	15800
Korea, Rep. of	-	-	39	15072
Vietnam	40	23129	15	5941
USA	5	5231	4	2787
Hong Kong	-	-	2	968
France	-	-	1	270
UK	++	195	++	223
Germany	-	-	++	222
Other countries	91	50951	-	-

**Table – 15 : Imports of Antimony Alloys & Scrap  
(By Countries)**

Country	2014-15		2015-16 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
<b>All Countries</b>	<b>1024</b>	<b>583886</b>	<b>1163</b>	<b>520245</b>
China	746	424668	983	439554
Japan	51	27089	89	39243
Thailand	91	52170	30	15800
Korea, Rep. of	-	-	39	15072
Vietnam	40	23129	15	5941
USA	5	5476	4	2905
Hong Kong	-	-	2	968
France	++	70	1	270
Germany	++	89	++	250
UK	++	243	++	242
Other countries	91	50952	-	-



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Exports of antimony alloys and scrap were 2,034 tonnes in 2015-16 against 2,371 tonnes in the previous year. Exports were mainly to USA (60%), Pakistan (16%) and Netherlands (11%) (Tables- 4 to 9).

### Imports

During 2016-17, imports of antimony ores and concentrates were 4,756 tonnes. Imports were mainly from Tajikistan (55%), Russia (6%) and Kazakhstan (34%). Imports of antimony ores and concentrates increased by 13% to 5,330 tonnes in 2015-16 from 4,711 tonnes in the previous year. Imports were mainly from Tajikistan (64%), Australia (25%) and Kazakhstan (7%).

Imports of antimony alloys and scrap increased considerably by 14% to 1,163 tonnes in 2015-16 from 1,024 tonnes in the previous year. Imports of alloys and scrap were mainly from China (85%) and Japan (8%) (Tables- 10 to 15).

### 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 55% 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 'Phase-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, little growth is anticipated for antimony metal in metallurgical and battery markets. 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.