

ANTIMONY



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(Part- II : Metals & Alloys)

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**ANTIMONY**

**(FINAL RELEASE)**

**GOVERNMENT OF INDIA  
MINISTRY 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. 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>	-	-	-	-	-	-	-	10588	-	10588
<b>Ore</b>	-	-	-	-	-	-	-	174	-	174
<b>Metal</b>	-	-	-	-	-	-	-	-	-	-
<b>By States</b>										
Himachal Pradesh										
Ore	-	-	-	-	-	-	-	10588	-	10588
Metal	-	-	-	-	-	-	-	174	-	174

*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 semi-conductors 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 off)</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 by 1% to 1,43,000 tonnes in 2016 as against 1,45,000 tonnes in the previous year. China with 75% production was the main producer of antimony in the world followed by Tajikistan (8%), Russia (5%), Australia (3%) and Bolivia & Myanmar (2% each) (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, 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.

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

(In tonnes of metal content)			
Country	2014	2015	2016
<b>World Total (rounded off)</b>	<b>181000</b>	<b>145000</b>	<b>143000</b>
Australia	3680	3926	5004
Bolivia	4186	3843	2669
Myanmar	10585	5777	2780
Canada	5	1	-
China	140389	112000	107525
Guatemala	-	-	25
Honduras	13	14	-
Iran	432	216	200 <sup>e</sup>
Kazakhstan <sup>e</sup>	800	700	900
Kyrgyzstan <sup>e</sup>	1450	1200	1880
Laos	620	1166	242
Mexico	266	90	166
Pakistan	127	114	21
Russia	6400 <sup>e</sup>	7420	6620
South Africa	816	400	1200 <sup>e</sup>
Tajikistan <sup>e</sup>	6500	5400	12000
Thailand	706	700 <sup>e</sup>	32
Turkey	3013	1917	2000 <sup>e</sup>
Vietnam	1098	219	204

*Source: World Mineral Production, 2012-16,*

## FOREIGN TRADE

### Exports

Exports of antimony ores & concentrates were 46 tonnes in 2016-17 as compared to 264 tonnes in the previous year. Exports of antimony alloys and scrap were 1,668 tonnes in 2016-17 against 2,034 tonnes in the previous year. Exports were mainly to USA (62%), Pakistan (24%) and Netherlands (4%). Exports of antimony (Unwrought) powders were 1,667 tonnes in 2016-17 as against 2,031 tonnes in 2015-16. Exports of antimonial lead were 12,231 tonnes in 2016-17 as compared to 4,960 tonnes in 2015-16 (Tables-4 to 8).

### Imports

Imports of antimony ores and concentrates decreased by 11% to 4,756 tonnes in 2016-17 from 5,330 tonnes in the previous year. Imports were mainly from Tajikistan (55%), Kazakhstan (34%) and Russia (6%).

Imports of antimony alloys and scrap decreased considerably by 25% to 864 tonnes in 2016-17 from 1,163 tonnes in the previous year. Imports of alloys and scrap were mainly from China (83%) and Japan (7%) (Tables-9 to 13).

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>264</b>	<b>115561</b>	<b>46</b>	<b>9646</b>
Austria	120	24185	46	9636
Bangladesh	-	-	++	9
UK	-	-	++	1
China	120	85854	-	-
Italy	24	5522	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>2031</b>	<b>838692</b>	<b>1667</b>	<b>746682</b>
USA	1214	498767	1037	465758
Pakistan	321	133729	405	178487
Netherlands	215	89805	63	26627
Japan	80	32059	30	13264
Mexico	-	-	21	11083
Brazil	-	-	20	10857
South Africa	25	10877	25	9750
Belgium	-	-	20	7684
UK	-	-	10	6218
UAE	20	10625	11	5309
Other countries	156	62830	25	11645

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
<b>All Countries</b>	<b>3</b>	<b>2211</b>	<b>1</b>	<b>3377</b>
Germany	++	691	1	3047
Malaysia	-	-	++	273
Norway	-	-	++	31
Nepal	-	-	++	24
Singapore	-	-	++	2
Saudi Arabia	1	1213	-	-
Oman	1	181	-	-
Bangladesh	1	126	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
<b>All Countries</b>	<b>2034</b>	<b>840903</b>	<b>1668</b>	<b>750059</b>
USA	1214	498767	1037	465758
Pakistan	321	133729	405	178487
Netherlands	215	89805	63	26627
Japan	80	32059	30	13264
Mexico	-	-	21	11083
Brazil	-	-	20	10857
South Africa	25	10877	25	9750
Belgium	-	-	20	7684
UK	-	-	10	6218
UAE	20	10625	11	5309
Other countries	159	65041	26	15022

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>4960</b>	<b>655652</b>	<b>12231</b>	<b>1734253</b>
Korea, Rep. of	2476	339547	3579	511259
USA	51	6645	3639	500599
UAE	371	46448	2083	307225
Bangladesh	362	46684	657	92491
Indonesia	124	15396	448	63625
Vietnam	-	-	353	58443
Cuba	435	55562	336	44979
Nepal	241	31240	321	43866
Oman	468	56752	171	21498
Japan	20	2654	100	16037
Other countries	412	54724	544	74231

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>5330</b>	<b>924223</b>	<b>4756</b>	<b>752103</b>
Tajikistan	3403	631165	2612	483535
Kazakhstan	373	36288	1618	165880
Russia	-	-	286	41470
Italy	68	32480	90	36440
Turkey	60	11068	80	15186
Thailand	-	-	70	9592
Australia	1326	177254	-	-
Myanmar	100	35911	-	-
Austria	++	57	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>4385</b>	<b>554014</b>	<b>7626</b>	<b>1069821</b>
Korea, Rep. of	2893	380840	4773	664518
UAE	902	103498	780	100204
Indonesia	-	-	468	81383
Malaysia	215	25231	531	72335
Australia	83	10531	203	30976
Canada	-	-	147	25444
Nigeria	53	6293	99	12130
Mexico	40	4917	75	9090
China	-	-	++	1
Vietnam	100	11692	-	-
Other countries	99	11012	550	73740

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>++</b>	<b>376</b>	<b>22</b>	<b>8067</b>
China	-	-	22	8037
USA	++	118	++	12
Germany	++	28	++	7
Italy	-	-	++	6
UK	++	19	++	5
Japan	++	211	-	-

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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>1163</b>	<b>519868</b>	<b>842</b>	<b>388642</b>
China	983	439553	691	316418
Japan	89	39032	60	32985
Vietnam	15	5941	31	15046
Turkey	-	-	24	8418
UK	++	223	20	6924
Russia	-	-	11	5423
USA	4	2787	2	2229
France	1	270	3	1173
Belgium	-	-	++	26
Thailand	30	15800	-	-
Other countries	41	16262	-	-



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

Country	2015-16 (R)		2016-17 (P)	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
<b>All Countries</b>	<b>1163</b>	<b>520244</b>	<b>864</b>	<b>396709</b>
China	983	439553	713	324455
Japan	89	39243	60	32985
Vietnam	15	5941	31	15046
Turkey	-	-	24	8418
UK	++	242	20	6929
Russia	-	-	11	5423
USA	4	2905	2	2241
France	1	270	3	1173
Belgium	-	-	++	26
Germany	++	250	++	7
Other countries	71	31840	++	6

## 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.