Indian Minerals Yearbook 2015

(Part- II : Metals & Alloys)

54th Edition

ANTIMONY

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
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July, 2017

2 Antimony

Antimony is a strategic metal. The predominant ore of antimony is stibnite composed of antimony trisulphide, Sb_2S_3, (Sb 71.4%). 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. One of the studies conducted by HZL was related to recovery of antimony-rich residue from antimony dross of pyro-smelter. 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 UNFC system, as on 1.4.2013, total resources are 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, Bihar, Jammu & Kashmir, 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 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 pharmaceuticals 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 1.4.2013
(By Grades/States)

(In '000 tonnes)

Grade/State	Reserves				Remaining resources								Total resources (A+B)
	Proved STD111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total (B)	
		STD121	STD122			STD221	STD222						
All India : Total													
Ore	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10588**	**0**	**10588**	**10588**
Metal	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**174**	**0**	**174**	**174**
By States													
Himachal Pradesh													
Ore	0	0	0	0	0	0	0	0	0	10588	0	10588	10588
Metal	0	0	0	0	0	0	0	0	0	174	0	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 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 by, and then consumed by, the Lead-acid Battery Industry.

WORLD REVIEW

The world reserves of antimony are 2 million tonnes in terms of metal content. Antimony reserves are located mainly in China, which contributes about 48% of the total reserves followed by Russia (18%), Bolivia (16%), Australia (7%) & USA (3%) (Table-2).

The world production of antimony metal decreased to 1,56,683 tonnes in 2014 as against 1,94,302 tonnes in the previous year. China with 77% production was the main producer of antimony in the world followed by Russia & Tajikistan (4% each) and Turkey (3%) (Table-3).

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

(In tonnes of metal content)

Country	Reserves
World : Total (rounded)	20,00000
Australia	1,39000
Bolivia	310000
China	950000
Russia (Recoverable)	350000
South Africa	27000
Tajikistan	50000
USA	60000
Other countries	100000

Source: *Mineral Commodity Summaries, 2016.*

China

China was 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. The Flame retardant Sector was the leading consumer of antimony and accounted for about 50% of the total followed by battery alloys, (17%), plastic stabilisers, (15%), glass (10%) and others(8%).

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

(In tonnes of metal content)

Country	2012	2013	2014
World : Total	**175989**	**194302**	**156683**
Australia	1950	3277	3828
Bolivia	5081	5053	4186
Myanmar	5900[e]	7400[e]	3300[e]
Canada	100	177	5
China	135600	152100	120000[e]
Guatemala	62	159	0
Kazakhstan	600	900	800
Kyrgyzstan	924	900	2450
Laos	521	804	620
Mexico	169	294	271
Morocco	710	1000[e]	1000[e]
Pakistan	12	89	127
Russia[e]	6400[e]	6520	6500
South Africa	3044	2332	816
Tajikistan	6645	7307	6500
Thailand	672	488	706
Turkey	7119	4512	4500[e]
Vietnam	480	990	1074

Source: *World Mineral Production, 2010-14*

FOREIGN TRADE

Exports

Exports of antimony ores & concentrates was not reported during the year 2014-15 as against the negligible quantity reported during 2013-14. Exports of antimony (Unwrought), powders was 2,325 tonnes in 2014-15 as against 1,837 tonnes in 2013-14. Exports were mainly to USA (51%) followed by Pakistan (23%) and Thailand (8%).

Exports of antimony alloys and scrap were 2371 tonnes in 2014-15 against 1864 tonnes in the previous year. Exports were mainly to USA (50%), Pakistan (23%) and Thailand (8%). (Tables 4 & 8).

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

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**++**	**8**	**-**	**-**
Nepal	++	8	-	-

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

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1839**	**1058058**	**2325**	**1208372**
USA	820	453137	1185	599815
Pakistan	522	313960	539	291838
Thailand	100	55907	195	102506
Mexico	-	-	125	66692
Netherlands	128	73948	116	57832
Japan	180	105346	70	38235
UAE	46	28006	51	27378
Spain	-	-	24	12697
Nepal	-	-	16	8111
Nigeria	8	6844	3	257
Other countries	35	20910	1	761

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

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**25**	**5412**	**46**	**1391**
Bangladesh	19	1072	46	1249
Nepal	++	118	++	142
Other countries	6	4222	-	-

Table – 7: Exports of Antimony Alloys & Scrap (Including ores, Conc, Unwrought, Articles NES) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1864**	**1063470**	**2371**	**1209763**
USA	820	453137	1185	599815
Pakistan	522	313960	539	291838
Thailand	100	55907	195	102506
Mexico	_	_	125	66692
Netherlands	128	73948	116	57832
Japan	180	105346	70	38235
UAE	48	29049	51	27378
Spain	_	_	24	12697
Nepal	++	118	16	8253
Nigeria	9	8684	3	2507
Other countries	57	23321	47	2010

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

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**11943**	**1650136**	**10628**	**1452384**
Korea, Rep.of	8145	1118481	5667	778813
Bangladesh	1692	237013	1737	233188
Oman	500	70760	1312	176910
Cuba	_	_	630	81671
Egypt	22	3625	495	69350
Nepal	115	14102	214	29985
Korea, Dem. Peop. Rep.	_	_	129	17629
Nigeria	_	_	100	16789
Indonesia	240	34915	98	13126
Japan	_	_	84	12422
Other countries	1229	171240	162	22501

Imports

Imports of antimony ores and concentrates increased to 4,711 tonnes in 2014-15 from 3,464 tonnes in the previous year. Imports were mainly from Australia (35%), Tajikistan (30%) and South Africa (24%).

Imports of antimony alloys and scrap decreased to 1025 tonnes in 2014-15 from 1307 tonnes in the previous year. Imports of alloys and scrap was mainly from China (73%) (Tables- 9 to 13).

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

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**3464**	**888707**	**4711**	**1004076**
Australia	-	-	1641	321490
Tajikistan	64	12141	1403	272364
South Africa	2968	720780	1134	249965
Austria	-	-	261	60253
Italy	68	36948	88	46139
Myanmar	285	99337	100	39503
Bolivia	-	-	84	14352
Iran	-	-	++	10
Other countries	79	19501	-	-

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

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**3169**	**441263**	**4959**	**695252**
Korea, Rep. of	1134	159345	2557	360099
UAE	50	7222	675	91399
Malaysia	20	2605	463	68299
Australia	-	-	411	58355
Israel	1672	233074	291	41600
Vietnam	-	-	249	32332
Korea, Dem. Peop. Rep.	-	-	149	21013
Bangladesh	19	3364	90	12345
Sri Lanka	100	14112	25	3756
UK	-	-	28	3397
Other countries	174	21541	21	2657

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

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**10**	**6575**	**10**	**6597**
China	10	6280	10	6144
USA	++	90	++	245
Germany	-	-	++	89
France	++	205	++	70
UK	-	-	++	48
Other countries	-	-	++	1

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

Country	2013-14		2014-15	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1297**	**800219**	**1014**	**577289**
China	1068	658262	736	418524
Thailand	-	-	91	52170
Japan	-	-	51	27089
Vietnam	70	42646	40	23129
Peru	40	22020	36	19603
Sweden	51	33905	35	19415
Singapore	-	-	20	11916
USA	-	-	5	5231
UK	++	146	++	195
Australia	-	-	++	17
Other countries	68	43240	-	-

Table – 13 : Imports of Antimony Alloys & Scrap (Including ores, Conc, Unwrought, Articles NES) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹ '000)	Qty (t)	Value (₹ '000)
All Countries	**1307**	**806794**	**1025**	**583886**
China	1078	664542	746	424668
Thailand	-	-	91	52170
Japan	-	-	51	27089
Vietnam	70	42646	40	23129
Sweden	51	33905	35	19415
Peru	40	22020	36	19603
Singapore	-	-	20	11916
UK	++	146	++	244
USA	++	90	5	5476
Germany	++	10	++	89
Other countries	68	43435	1	87

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 telephones 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 lead 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.