

13 Antimony

Antimony is a strategic metal. Stibnite, composed of antimony trisulphide, Sb_2S_3 , (Sb 71.4%) is the predominant ore of antimony. 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 are unusual in nature that they expand 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, lead, copper and silver. The metal is obtained commonly as a by-product in lead-zinc-silver smelting.

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 1.4.2010, total resources of 10,588 tonnes ore with metal content of 174 tonnes are estimated all in inferred category 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 and Kashmir, Karnataka and Uttar Pradesh.

USES

Antimony and its alloys find numerous applications in a wide range of high technology industries like electronic, space and 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, 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 may be used in pharmaceuticals. 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 shifted to use of calcium as additive to substitute for 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 may be substituted for antimony chemicals in paints, pigments and enamels.

**Table – 1 : Reserves/Resources of Antimony as on 1.4.2010 (P)
(By States)**

India/State	Reserves Total (A)	Remaining resources		Total resources (A+B)
		Inferred (STD 333)	Total (B)	
India				
Ore	–	10588	10588	10588
Metal	–	174	174	174
Himachal Pradesh				
Ore	–	10588	10588	10588
Metal	–	174	174	174

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TECHNICAL POSSIBILITIES

Antimony products can be used as stabilizers in specialised plastics. Development of electric vehicles could lead to the use of high antimony batteries because of their deep cycling characteristics. Antimony semiconductors have possible use in aircraft night vision systems and in space-based astronomy. The antimonial lead scrap extracted from the spent lead acid storage batteries is recycled largely from and for storage battery industry. Antimony has found a new use in the manufacture of DVDs.

WORLD REVIEW

The world reserves of antimony are 2.1 million tonnes in terms of metal content. Antimony reserves are located mainly in China, which contribute about 38% to the total reserve base followed by Thailand (20%), Russia (17%), Bolivia (15%), South Africa (2%) and Tajikistan (2%) (Table-2).

The world production of antimony metal decreased to 179,000 tonnes in 2009 as against 199,000 tonnes in the previous year. China was the main producer of antimony accounting for about 92% of world production. Russia, Bolivia, South Africa and Kyrgyzstan were the other important producers (Table-3).

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

(In tonnes of metal content)

Country	Reserves
World : Total (rounded)	2100000
Bolivia	310000
China	790000
Russia (Recoverable)	350000
South Africa	44000
Tajikistan	50000
Thailand	420000
USA	–
Other countries	150000

Source: Mineral Commodity Summaries, 2010.

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

(In tonnes of metal content)

Country	2007	2008	2009
World : Total	177000	199000	179000
Bolivia	3881	3905	2990
China	163000	183000	166200
Gutemala	365	–	–
Kyrgyzstan	250	250	918
Peru	590	531	145
Russia ^(e)	3000 ^(e)	3000 ^(e)	3000
South Africa	3436 ^(e)	3674 ^(e)	2090
Other countries	2478	4640	3657

Source: World Mineral Production, 2005-2009.

China

China dominates the world antimony production. Hsikwangshen Twinkling Star Antimony Co. is China's largest antimony metal and trioxide producer. However, an accident halted all underground operations in Hsikwangshan main mine. The company has two smelters, both with a capacity of 1000 t/month. There are known to be more than 100 small antimony producers in Hunan accounting for 10,000 to 20,000 tpy.

FOREIGN TRADE

Exports

Exports of antimony alloys and scrap was 32 tonnes in 2009-10 against 57 tonnes in the previous year. Exports were mainly to Nigeria and USA (Table - 4).

Imports

Imports of antimony ores and concentrates increased to 898 tonnes in 2009-10 from 476 tonnes in the previous year. Imports were mainly from South Africa. Imports of antimony alloys and scrap in 2009-10 were 927 tonnes compared to 967 tonnes in the previous year. Imports were mainly from China (71%) and Vietnam (12%) (Tables 5 and 6).

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**Table – 4 : Exports of Antimony Alloys and Scrap
(By Countries)**

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	57	17537	32	13998
Nigeria	–	–	17	7251
USA	2	875	8	2531
Switzerland	–	–	2	2380
South Africa	–	–	4	1377
Belgium	10	4008	–	–
France	10	2848	–	–
Myanmar	6	2003	–	–
Pakistan	12	3790	–	–
Thailand	5	1181	–	–
UAE	3	866	–	–
Other countries	9	1966	1	459

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	476	53767	898	94154
South Africa	105	16669	834	83143
Italy	1	229	18	3681
Austria	5	1506	9	2915
Bolivia	79	8495	14	2845
France	–	–	23	1569
China	20	4058	–	–
Mexico	185	16711	–	–
Netherlands	2	421	–	–
Peru	57	3983	–	–
Unspecified	22	1695	–	–
Other countries	–	–	++	1

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	967	245595	927	231371
China	766	197995	655	169527
Vietnam	79	18851	115	23219
Thailand	–	–	79	21185
Australia	–	–	49	11080
Korea, Rep. of	–	–	5	1089
Germany	1	219	4	907
USA	42	9051	++	3
Hong Kong	79	19479	–	–
Unspecified	–	–	20	4361

FUTURE OUTLOOK

Continued mining restrictions in China may result in higher market prices of antimony. 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. In flame-retardant sector, 4% annual growth is predicted for the next five years and the future of antimony will depend on this sector alone.

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 are commercialised and expected to find applications in mobile telephones and digital cameras. In contrast, little or no growth is anticipated for antimony metal in metallurgical and battery markets.