

ANTIMONY



# Indian Minerals Yearbook 2016



(Part- II : Metals & Alloys)

**55<sup>th</sup> Edition**

**ANTIMONY**

**(ADVANCE RELEASE)**

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

Indira Bhavan, Civil Lines,  
NAGPUR – 440 001

PHONE/FAX NO. (0712) 2565471  
PBX : (0712) 2562649, 2560544, 2560648  
E-MAIL : [cme@ibm.gov.in](mailto:cme@ibm.gov.in)  
Website: [www.ibm.gov.in](http://www.ibm.gov.in)

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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<br>STD111 | Probable<br>STD121    STD122 | Total<br>(A) | Feasibility<br>STD211 | Pre-feasibility<br>STD221    STD222 | Measured<br>STD331 | Indicated<br>STD332 | Inferred<br>STD333 |                       | Reconnaissance<br>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 are 1.5 million tonnes in terms of metal content. Antimony reserves are located mainly in China, which contributes about 35% of the total reserves followed by Russia (23%), Bolivia (21%), Australia (11%), USA (4%) & Tajikistan (3%) (Table-2).

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

(In tonnes of metal content)

| Country                        | Reserves |
|--------------------------------|----------|
| <b>World : Total (rounded)</b> | 1500000  |
| Australia                      | 160000   |
| Bolivia                        | 310000   |
| China                          | 530000   |
| Mexico                         | 18000    |
| Russia (Recoverable)           | 350000   |
| South Africa                   | 27000    |
| Tajikistan                     | 50000    |
| USA                            | 60000    |

Source: Mineral Commodity Summaries, 2017.

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 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.

## FOREIGN TRADE

### Exports

Export of antimony ores & concentrates was at 264 tonnes during 2015-16. Export was mainly to China & Austria (45% each) as against the nil quantity reported during 2014-15. Export of antimony (Unwrought), powders was 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%).

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 7).

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

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

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

| Country              | 2014-15     |                  | 2015-16 (P) |                  |
|----------------------|-------------|------------------|-------------|------------------|
|                      | Qty<br>(t)  | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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 – 6 : Exports of Antimony & Articles, NES  
(By Countries)**

| Country              | 2014-15    |                  | 2015-16 (P) |                  |
|----------------------|------------|------------------|-------------|------------------|
|                      | Qty<br>(t) | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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 – 7: Exports of Antimony Alloys & Scrap  
(By Countries)**

| Country              | 2014-15     |                  | 2015-16 (P) |                  |
|----------------------|-------------|------------------|-------------|------------------|
|                      | Qty<br>(t)  | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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 – 8 : Exports of Antimonial Lead  
(By Countries)**

| Country                | 2014-15      |                  | 2015-16 (P) |                  |
|------------------------|--------------|------------------|-------------|------------------|
|                        | Qty<br>(t)   | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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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**Imports**

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- 9 to 13).

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

| Country              | 2014-15     |                  | 2015-16 (P) |                  |
|----------------------|-------------|------------------|-------------|------------------|
|                      | Qty<br>(t)  | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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 – 10 : Imports of Antimonial Lead  
(By Countries)**

| Country                | 2014-15     |                  | 2015-16 (P) |                  |
|------------------------|-------------|------------------|-------------|------------------|
|                        | Qty<br>(t)  | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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 – 11 : Imports of Antimony & Articles , NES  
(By Countries)**

| Country              | 2014-15    |                  | 2015-16 (P) |                  |
|----------------------|------------|------------------|-------------|------------------|
|                      | Qty<br>(t) | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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 – 12 : Imports of Antimony (Unwrought), Powders  
(By Countries)**

| Country              | 2014-15     |                  | 2015-16 (P) |                  |
|----------------------|-------------|------------------|-------------|------------------|
|                      | Qty<br>(t)  | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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 – 13 : Imports of Antimony Alloys & Scrap  
(By Countries)**

| Country              | 2014-15     |                  | 2015-16 (P) |                  |
|----------------------|-------------|------------------|-------------|------------------|
|                      | Qty<br>(t)  | Value<br>(₹'000) | Qty<br>(t)  | Value<br>(₹'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            | -           | -                |



## 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.