

Drastic change in the nature's behaviour with drought in some regions and flood elsewhere has forced global think tank to rework strategies and reduce discharge of obnoxious gases including carbon monoxide (CO), carbon di-oxide (CO₂), nitrogen oxide (NO_x) and sulphur di-oxide (SO₂) into the environment. With the United Nations (UN) taking the lead in this initiative, a parameter was set few years ago for all its signatories to adhere to it and set a stringent norm for all

Lead Recycling in Deep Distress

- Metalworld Research Team

Introduction

As a heavy, malleable, bluish grey metal, lead is one of the most resistant to common corrosion problems. This is a bright luster, dense, ductile, very soft and highly malleable bluish-white metal which can be toughened by adding a small amount of antimony or other metals to it. It is a naturally occurring element and is usually associated with other minerals, notably zinc, silver and copper. Trace amounts of other elements, including gold, are sometimes found with lead ore. The ore is mined, concentrated and then smelted in a blast furnace with limestone and coke. It is refined to remove and recover other metals. Lead is one of man's most valuable commodities in present scenario. Occurring naturally in the environment, the metal is mined and processed in some 60 countries. The usage

continues to increase and has risen from 4 million tonnes per year. Of this, nearly 2 million tonnes per year is produced in Asia. Secondary production or recycling is now widely practiced and currently accounts for some about 50 per cent of usage worldwide. Lead has some important properties, in particular malleability (i.e. it can be hammered into shape), ease of production, ease of melting and joining, and good corrosion resistance. As a result, it has been used for purposes such as roofing, window canes, piping, kitchen/tableware and ornamental uses for many centuries. The electrochemical properties of lead enable it to be used in storage batteries in all motor vehicles, and for some back-up power supplies.

Certain compounds of lead, particularly brightly coloured lead oxides, and leaded glasses and leaded glazes on

ceramics, have been used for millennia. The main producers of lead mineral are: China, Australia, USA, Peru, Canada and Mexico. These six countries produce three quarters of world output. The largest exporters of lead metal are nations which mine large quantities of lead ore: China, Australia and Canada. All industrialized nations use lead. The USA is by far the greatest consumer, most of it being used for batteries. Other major consumers are: China, UK, Germany, Japan, Republic of Korea, France and Italy. Spain, Mexico and Brazil use less. In India about 75 per cent of total demand is from the domestic battery industries. Demand is growing at the rate of 6-7 per cent per annum and will continue to grow in the near future. Annual demand for lead is nearly 1.60 lakh tones. Domestic demand is fed up by mine production and recycling. But in India the recycling



sector is not performing well in comparison to other developed countries so the share of recycled metals in domestic supply is not significant. Mostly lead is mined as co-product of zinc so the prices and supply demand is highly affected by the zinc market. India's lead production rate is not stagnant it keeps changing year-by-year.

Tough Going

Of the secondary producers' contribution of 320,000 tonnes, nearly 250 – 300 unorganised sector players mainly smaller ones in remote Indian cities contribute around 170,000 tonnes. These producers randomly consider installing pollution control equipment. Nearly 30–40 organised sector players like Gravita India Ltd and others, however, have installed all mandatory equipment for controlling discharge of obnoxious gases into the environment while processing of lead through secondary sources. These players contribute 150,000 tonnes of lead output annually. India's secondary lead industry is likely to witness a sea change in the next few years due to stringent environment guidelines framed by state pollution control boards (SPCB). Organised sector players are set to get a majority of share of smelters in unorganised sector. The country's total lead demand stands today at 600,000 tonnes. Hindustan Zinc, the only producer of primary metal produces around 70,000 tonnes while the remaining is met through a combination of secondary producers and imports. The remaining around 33 per cent or 200,000 tonnes of India's lead demand

is met through imports. Lead demand in the country is growing at 12 per cent due to rapid growth in infrastructure as against 6 per cent of global average. SPCBs in the industrialised states have come out with stringent regulations for processing of secondary lead from battery scrap. Under these regulations, all plants engaged in this sector require to install pollution control equipment before seeking a clearance from SPCB. Since, small unorganised sector players do not have financial capability to install pollution control equipment, they will not get their license renewed, said an official SPCB.

Capacity Ramp Up

Meanwhile, in order to step up production Jaipur – based Gravita India plans to ramp up capacity from the existing 35,400 tonnes to 1,21,125 tonnes by 2013–14 at an investment of Rs 100 crore. For the current financial year, however, the company plans to invest Rs 40 crore to expand production capacity to 79,125 tonnes. This will benefit companies like Gravita, said M C Mehta, president of the company. Gravita has recently acquired controlling rights in KM Udyog, Jammu, a lead remelting unit with production capacity of 7,200 tonnes. The production activity is set to commence on this plant by the end of this month. The unit will derive advantage of benefits for its operations and sale of products by way of exemption from excise duty, income tax etc. as per the special benefits granted by state of Jammu & Kashmir. The company proposes to set up manufacturing units in the countries of Australia, Belarus, Chile and Mexico.

These manufacturing units will be primarily involved in manufacture of remelted lead ingots. The company has also finalised a joint venture in South Africa and plans to set up one in Saudi Arabia. Scrap lead battery which feeds secondary lead smelter is adequately available in India due to auto sector boom. A battery in auto sector is mandatory replaced in four years for better efficiency and hence, the availability of lead acid battery will not be a problem for capacity expansion, said Mehta. Other processing units also plan similar capacity expansion to meet rising demand in India.

Global View

Globally, secondary lead production growth is rising particularly in countries such as Australia, European Union, the US and Japan. Our country lacks technology and policy to promote production of secondary lead in a big way which causes high fluctuation in the domestic supply and imbalance in export and import which is changed every year. Roughly half of lead comes from recycled lead, it is worth noting that in times of low lead prices, the collection of scrap can become unprofitable and this has a marked impact on lead supply. Likewise, when lead prices are high, there is a bigger incentive to find lead scrap and to supply it to the market. This makes lead more responsive to changes in price, than some of other metals that are more dependent on primary production and have relatively small secondary supply. Demand for lead-acid batteries for automotive, industrial and consumer purposes account for 70% of the world's demand for lead. Lead's corrosion-resistant nature also lends itself for applications in sheeting for roofing purposes, while its radiation attenuation properties prevent the emission of harmful radiation from television, video and computer monitors. Certain dispersive or readily bio-available uses, such as lead in gasoline, in piping for drinking water systems, and in household paints, have been or are being phased out in USA, China, Australia, Canada and in certain other countries due to health concerns. The lead acid battery is overwhelmingly the principal use of lead, with almost three quarters of world lead production applied to

battery manufacture. The use of the batteries is changing, however. While the lead battery has the market for SLI (starter, lights and ignition), there is increasing demand for stationary and electric vehicle batteries. The lead battery is maintaining its dominant position among the competing battery technologies through improving efficiency, reliability and cost.

Processing

The US is the third largest producer of primary lead, with most coming from Missouri. The primary end users of lead are batteries and ammunition. Primary Lead Processing Primary lead production begins with sintering. Concentrated lead ore is fed into a sintering machine with iron, silica, limestone fluxes, coke, soda ash, pyrite, zinc, caustics or pollution control particulates. The mixture is blasted with hot air to burn off the sulfur and sent to the smelter. Lead is usually smelted in a blast furnace using the carbon from the sintering machine to provide the heat source. As melting occurs, several layers form in the furnace. The molten lead layer sinks to the bottom of the furnace. A layer of the lightest elements, including arsenic and antimony, floats to the top and is referred to as the "speiss." A "matte" layer also forms from the copper and metal sulfides. Finally, a layer of blast furnace slag, which contains mostly silicates, also forms. The speiss and the matte are usually sold to copper smelters where they are refined for copper processing. The slag is stored and partially recycled, if the metal content is sufficient. The lead from the blast furnace, called lead bullion, then undergoes the drossing process. The bullion is agitated in kettles then cooled to 700-800 degrees. This process results in molten lead and dross. Dross refers to the lead oxides, copper, antimony and other elements that float to the top of the lead. Dross is usually skimmed off and sent to a dross furnace to recover the non-lead components which are sold to other metal manufactures. Finally, the molten lead is refined. Pyrometallurgical methods are usually used to remove the remaining non-lead components of the mixture. The non-lead metals are usually sold to other metal processing plants. The refined

lead may be made into alloys or directly cast.

Most of the lead produced comes from secondary sources. Lead scrap includes lead acetate batteries, cable coverings, pipes, sheets and lead coated, or tern bearing, metals. Solder product waste and dross may also be recovered for its small lead content. Most secondary lead is used in batteries. To recover lead from a battery, the battery is broken and the components are classified. The lead containing components are processed in blast furnaces for hard lead or rotary reverberatory furnaces for fine particles. The blast furnace is similar in structure to a cupola furnace used in iron foundries. The furnace is charged with slag, scrap iron, limestone, coke, oxides, dross, and reverberatory slag. The coke is used to melt and reduce the lead. Limestone reacts with impurities and floats to the top. This process also keeps the lead from oxidizing. The molten lead flows from the blast furnace into holding pots. Lead may be mixed with alloys, including antimony, tin, arsenic, copper and nickel. It is then cast into ingots.

A Profitable Turning

Scrap recycling is a profitable business which provides margins up to 20 per cent. But, margins get squeezed once prices of virgin metals decline as consumers prefer virgin metals to secondary ones. Still recycling of scrap offers margins between 10-15 per cent depending upon the metal and grade of scrap processing. Therefore, scrap recycling should be encouraged, said Surendra Mardia, president of Bombay Metal Exchange (BME). But, unfortunately, such a wonderful business is underplayed in India for environmental concerns and other issues of vested interest. In China, however, the government has built up several scrap market yards for looking after scrap imports and supply to domestic processors. Channelizing of proper scrap trading and adequate timely supply of scrap has lured many suppliers to sell scrap hassle free to China instead of India, said Mardia. In India, however, not a single such yard has been set up. Instead, the government has levied several restrictions for scrap imports under the aegis of "radioactive materials". If



Lead - Industrial Consumption (Percent)

Batteries	71
Pigments and Other Compounds	12
Rolled and Extruded Products	7
Shot / Ammunitions	6
Cable Sheathing	3
Alloys	1

proper channel is installed and scrap recycling is clubbed with the mandatory installation of anti pollution equipment, the issue of hazardous metals import can be shorted out in India in line with China.

Conclusion

Import of non-ferrous scrap including lead has declined a phenomenal 25 per cent in the first 11-month of the financial year indicating a sharp fall in recycling activities in the current weakening market sentiment. Domestic smelters always import scrap of different varieties to produce secondary metal for different applications. Arrival of scrap in the domestic market sets the trend of overall supply of base metals. Recycling of used metals, be it scrap or secondary articles, has assumed significance especially in the developing countries like India where re-processing, on one hand, is needed to meet the raw material deficit, and, on the other hand, has posed a great ecological concern. Amid signs of challenges and threat, metallurgists are exploring solutions that can resolve both issues. Scrap is commonly used as raw materials for ultimate metals production. But, scrap collection and shipment thereof remain problematic for environmental concerns whereby the importer needs to prove that the consignment contains no hazardous materials including metals, minerals, chemicals and most importantly radio-active materials.

○○○