2011 Minerals Yearbook

BISMUTH [ADVANCE RELEASE]

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Bismuth

By James F. Carlin, Jr.

Domestic survey data and tables were prepared by Raymond I. Eldridge III, statistical assistant, and the world production table was prepared by Lisa D. Miller, international data coordinator.

Bismuth consumption in the United States was estimated to be 715 metric tons (t), 19% less than that in 2010 (tables 1, 2). The estimated value of bismuth consumed domestically was $16 million in 2010 and $18 million in 2011.

Bismuth was last produced domestically, as a byproduct of lead refining, at a Nebraska refinery that closed in 1997. The last stocks of bismuth in the National Defense Stockpile were sold that same year. In 2011, all primary bismuth consumed in the United States was imported. A small amount of bismuth was obtained by remelting old scrap. The leading producers of refined bismuth in 2011 were, in descending order, China, Mexico, Belgium, and Peru. Belgium had no bismuth mine production, and its sole bismuth producer refined metal from imported anode slimes, concentrates, smelter residues, and flue dust. The principal suppliers to the United States were, in descending order by weight, China, Belgium, Kazakhstan, the United Kingdom, and Canada.

In recent years, new uses for bismuth as a nontoxic substitute for lead have been developed. These include the use of bismuth in shot for water fowl hunting, lubricating greases, pigments, and solders.

The annual average dealer price for bismuth in 2011 was $11.47 per pound, an increase of 31% from that in 2010. Industry observers attributed the price increase to a moderate increase in global demand combined with a slight decrease in global bismuth refinery production.

Production

Domestic production of primary refined bismuth ceased in 1997. Some domestic firms continued to remelt bismuth alloy scrap. Secondary production was estimated to be less than 5% of domestic supply during 2011.

Consumption

The U.S. Geological Survey surveys domestic bismuth consumption annually. The amount used by nonrespondents is estimated based on reports from prior use or on information from other sources. Estimated bismuth consumption was about 715 t in 2011, a 19% decrease from that in 2010.

Bismuth usage in pharmaceuticals included bismuth salicylate (the active ingredient in over-the-counter stomach remedies) and other bismuth medicinal compounds used to treat burns, intestinal disorders, and stomach ulcers in humans and animals. Bismuth nitrate was the initial material used for the production of most bismuth pharmaceutical compounds. Other applications of bismuth chemicals and compounds included uses in superconductors and pearlescent pigments for cosmetics and paints.

Bismuth metal was used primarily as a major constituent of various alloys and as a metallurgical additive (table 2). One class of bismuth alloys consists of fusible (low-melting-point, as low as 20° C) alloys, which are combinations of bismuth with other metals, such as antimony, cadmium, gallium, indium, lead, and tin. Applications for those alloys included fuel tank safety plugs, holders for optical lenses and other articles for machining or grinding, solders, and fire sprinkler triggering mechanisms. Bismuth was also added in small amounts to aluminum and copper alloys to improve machinability and to malleable iron graphite flakes to improve quality.

In addition to lead-free glasses, pigments, shot and solder, bismuth has been a substitute for lead added to certain steel products to provide greater machinability. Although bismuth has been used successfully to replace lead in various applications, it has been challenged as a lead substitute by tin and tungsten in some applications.

Price

In 2011, the average Platts Metals Week New York dealer price for bismuth rose to $11.47 per pound, an increase of 31% from that in 2010. The weekly average bismuth price range started 2011 at $9.10 to $9.60 per pound, increased to $11.50 to $11.70 per pound by midyear, and was at $11.50 to $12.00 per pound at yearend. The price rise during the year was attributed to a moderate increase in global consumption combined with a small decrease in global refinery output.

Foreign Trade

U.S. exports of bismuth alloys, metal, and waste and scrap were 1,030 t, a slight decrease from that in 2010. U.S. imports of bismuth metal were 1,750 t, an increase of 8% compared with that in 2010. The leading import source was China, which supplied 56% of the United States imports.

World Review

Bismuth was produced principally as a byproduct of the smelting of lead ores. In China, however, it was also a byproduct of fluorspar, tin, and tungsten ore processing. In Bolivia, the Tasna Mine, the only mine in the world known to have produced bismuth from bismuth ore, has been on standby since the mid-1990s, awaiting a sustained rise in the metal price.

World refinery production of bismuth was 15,700 t, a 3% decrease from that in 2010. China was the world's leading producer of refined bismuth with 80% of the world total, followed by Mexico (6%) and Belgium (5%).

Fortune Minerals Ltd. (London, Ontario, Canada) reported that its NICO gold-cobalt-bismuth-copper project in the

Northwest Territories had moved to the next stage of the environmental assessment process after passing conformity tests in August and meeting obligations of the information request stage in December. The MacKenzie Valley Review Board continued conducting an environmental assessment. The 31-million-metric-ton deposit was planned to be developed using open pit and underground mining with an ore processing rate of 4,560 metric tons per day (t/d) during an 18-year mine life. Fortune planned to produce about 180 t/d of bulk concentrate for shipment to the company's proposed hydrometallurgical refinery near Saskatoon, Saskatchewan. Fortune expected to be a supplier of 99.5% bismuth cathode and 99.99% bismuth ingot as well as cobalt, copper, gold, and nickel products (Fortune Minerals Ltd., 2011).

Outlook

Prior to the onset of the 2008 global recession, world bismuth consumption had been increasing at about 3% to 5% per year. However, the ongoing global economic slowdown led to a substantial contraction in consumption. World consumption of bismuth in the steel sector has decreased, although the decrease was relatively minor compared with that in other use sectors.

Most of bismuth's end uses, especially its use as a metallurgical additive, are in the industrial sectors of the economy. An increase in demand will likely depend on economic growth in the world's industrialized emerging nations.

Commercial and research organizations in Europe, Japan, and North America have agreed to a framework to eliminate lead from solders in manufacturing. This agreement could increase the demand for bismuth—bismuth is already used in some solders. Many Japanese manufacturers were using lead-free solders in some or all of their soldering applications, and studies on lead-free solders were being performed independently by researchers in the European Union, Japan, the Republic of Korea, and the United States.

Primary lead mine production was expected to increase worldwide, in 2011 and 2012, by 9%, and 5%, respectively; although bismuth byproduct is produced from only a few of the world's lead mines; despite potential increases in world demand, supplies from China can be expected to help stabilize the bismuth market, unless China decides to restrict bismuth exports as it had done in the past for some other materials.

Reference Cited

Fortune Minerals Ltd., 2011, Fortune Minerals announces NICO permitting update: London, Ontario, Canada, Fortune Minerals Ltd. press release, December 16, 2 p. (Accessed February 2, 2012, at http://fortuneminerals.com/News/Press-Releases/Press-Release-Details/2011/Fortune-Minerals-Announces-NICO-Permitting-Update1127685/default.aspx.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

Bismuth. Ch. in Mineral Commodity Summaries, annual.
Bismuth. Ch. in United States Mineral Resources, Professional Paper 820, 1973.
Bismuth. Mineral Industry Surveys, quarterly.
Historical Statistics for Mineral and Material Commodities in the United States, Data Series 140.

Other

Bismuth. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1
SALIENT BISMUTH STATISTICS[1]

		2007	2008	2009	2010	2011
United States:						
Consumption[e]	metric tons	2,630 r	1,080 r	820 r	884 r	715
Exports[2]	do.	421 r	375 r	397 r	1,040 r	1,030
Imports for consumption	do.	3,070 r	1,930 r	1,250 r	1,620 r	1,750
Price, average, domestic dealer	dollars per pound	14.07	12.73	7.84	8.76	11.47
Stocks, December 31, consumer	metric tons	139	228	134	134	138
World production:[e, 3]						
Mine, metal content[4]	do.	6,400 r	7,660 r	7,590 r	7,820 r	8,330
Refinery	do.	15,400 r	16,400 r	15,300 r	16,200 r	15,700

[e]Estimated. [r]Revised. do. Ditto.
[1]Data are rounded to no more than three significant digits.
[2]Comprises bismuth metal and the bismuth content of alloys and waste and scrap.
[3]Data are rounded to no more than two significant digits.
[4]Excludes the United States.

TABLE 2
ESTIMATED BISMUTH METAL CONSUMED
IN THE UNITED STATES, BY USE[e, 1]

(Kilograms)

Use	2010	2011
Chemicals[2]	589,000	W
Bismuth alloys	62,000	60,300
Metallurgical additives	231,000	222,000
Other	2,800 r	W
Total	884,000	715,000

[e]Estimated. [r]Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Includes industrial and laboratory chemicals, cosmetics, and pharmaceuticals.

TABLE 3
U.S. EXPORTS OF BISMUTH METAL, ALLOYS, AND WASTE AND SCRAP,
BY COUNTRY[1]

	2010		2011	
Country	Quantity (kilograms, metal content)	Value (thousands)	Quantity (kilograms, metal content)	Value (thousands)
Argentina	391	$19	52	$11
Australia	934	11	--	--
Austria	20,000	190	--	--
Belgium	14,800	255	--	--
Brazil	10,600	96	12,200	111
Canada	41,400	947	20,700	480
China	26,400	240	28,000	253
Colombia	743	27	1,240	11
Costa Rica	12,500	130	11,600	120
Dominican Republic	--	--	570	12
France	215,000 r	2,130 r	44,100	400
Germany	73,500	668	9,320	85
Guatemala	1,090	7	--	--
Hong Kong	9,260	84	1,490	20
India	644	8	1,960	27
Japan	4,160	106	21,900	240
Mexico	100,000	1,160	219,000	2,410
Singapore	2,060	54	9,690	135
Taiwan	526	13	1,770	20
Thailand	21,700	200	10,900	200
United Kingdom	1,320	29	7,810	107
Vietnam	480,000 r	6,300 r	621,000	5,660
Other	483	63 r	10,900	74
Total	1,040,000 r	12,700 r	1,030,000	10,400

[r]Revised. -- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 4

U.S. IMPORTS FOR CONSUMPTION OF METALLIC BISMUTH, BY COUNTRY[1]

Country	2010 Quantity (kilograms)	2010 Value (thousands)	2011 Quantity (kilograms)	2011 Value (thousands)
Belgium	674,000	$12,900	713,000	$17,300
Canada	21,300	339	11,600	285
China	875,000	15,400	974,000	22,100
Germany	4,090	205	824	49
Hong Kong	297	2	--	--
Italy	200	45	--	--
Japan	3	4	--	--
Kazakhstan	10,000	195	26,700	627
Korea, Republic of	40	3	135	7
Mexico	373	75	60	3
Netherlands	15	3	--	--
Peru	455	8	--	--
Russia	499	65	--	--
United Kingdom	35,800	761	22,700	666
Other	--	--	5	2
Total	1,620,000	30,100	1,750,000	41,100

-- Zero.

[1]Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 5

BISMUTH: ESTIMATED WORLD MINE AND REFINERY PRODUCTION, BY COUNTRY[1, 2]

(Metric tons)

Country	Mine 2007	Mine 2008	Mine 2009	Mine 2010	Mine 2011	Refinery 2007	Refinery 2008	Refinery 2009	Refinery 2010	Refinery 2011
Belgium	--	--	--	--	--	800	800	800	800	800
Bolivia[3]	147	28	54	87	100	--	92	73	--	--
Bulgaria	45	45	45	45	45	4 r	6 r	-- r	3 r	3
Canada[4]	137 [3]	71	86 [3]	91	92 p	200	150	150 [3]	150	150
China	3,500	5,000	6,000	6,500	7,000	12,100	13,100	12,300	13,000	12,500
Italy	--	--	--	--	--	5	5	5	5	5
Japan[5]	20	24 r	21	23 r	23	408	480	423	454 r	450
Kazakhstan	145	150	-- r	-- r	--	-- r	-- r	90 r	150 r	150
Mexico	1,200	1,170	854	982 r	980	1,200	1,170	854	982 r	980
Peru	1,114 r, 3	1,061 r, 3	423 r, 3	-- r, 3	--	600	600	600	600	600
Romania	40	40	40	40	40	30	30	30	30	30
Russia	55	70	65	50	45	12	13	12	10	9
Total[6]	6,400 r	7,700 r	7,600 r	7,800 r	8,300	15,000 r	16,000 r	15,000 r	16,000 r	16,000

[p]Preliminary. [r]Revised. -- Zero.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through March 30, 2012. Bismuth is produced primarily as a byproduct of other metals, mainly lead and tungsten.

[3]Reported figure.

[4]Figures listed under mine output are the metal content of concentrates produced.

[5]Mine output figures have been estimated to be 5% of reported metal output figures.

[6]World totals are rounded to no more than two significant digits.