

# Gallium

By Benjamin Petkof<sup>1</sup>

The domestic gallium industry continued to provide a significant portion of U.S. demand although gallium imports increased in 1978 and 1979. Data on world production and consumption were not available. Gallium was consumed for the production of various gallium compounds used to produce electronic devices.

**Legislation and Government Programs.**—New tariff rates for imported gallium metal and compounds resulted from the 1979 Tokyo round of tariff negotiations giving most nations "most-favored nation" status. The tariffs for these nations will decline annually, in stages, beginning January 1, 1980 and ending January 1, 1987.

**Table 1.—Salient gallium statistics in the United States**

(Kilograms)

	1975	1976	1977	1978	1979
Production -----	W	W	NA	NA	NA
Imports for consumption -----	6,830	4,920	2,884	3,721	6,401
Consumption -----	7,493	8,880	8,789	8,908	9,461
Price per kilogram -----	\$750-\$800	\$750-\$800	\$500-\$600	\$500-\$600	\$510

NA Not available. W Withheld to avoid disclosing company proprietary data.

## DOMESTIC PRODUCTION

The Aluminum Co. of America, using proprietary technology at its Bauxite, Ark., alumina plant, recovered gallium as a co-product from residues of its alumina production process. Eagle-Picher Industries, Inc., produced gallium metal, oxide, and

trichloride from zinc production residues at its Quapaw, Okla., facility. Production data are not available. Based on consumption and import data, total domestic output was thought to have declined in 1978 and 1979.

## CONSUMPTION

Gallium consumption was strong in 1978 and 1979 and was above that of 1977. The electronics industry had the greatest demand for high-purity material to fabricate light-emitting diodes, semiconductors, and other electronic devices. Small quantities of metal were used to prepare specialty alloys and in research and development. Gallium oxide was used for the preparation of phosphors.

General acceptance by the public of vari-

ous electronic devices that use gallium-based components helped sustain gallium demand. Continued interest in the development of gallium-based direct solar energy-conversion cells for the production of electricity and further development of fiber-optic light-transmission cables actuated by gallium-based light-emitting diodes, may stimulate demand for gallium and gallium compounds in the near future.

Table 2.—Consumption of gallium,  
by end use

(Kilograms)			
End use	1977	1978	1979
Alloys <sup>1</sup> -----	4	5	5
Electronics <sup>2</sup> -----	7,965	8,305	8,782
Research and development -----	763	584	617
Unspecified uses -----	57	14	57
<b>Total -----</b>	<b>8,789</b>	<b>8,908</b>	<b>9,461</b>

<sup>1</sup>Specialty alloys.<sup>2</sup>Light-emitting diodes, semiconductors, and other electronic devices.Table 3.—Stocks, receipts, and consumption of gallium<sup>1</sup>

(Kilograms)				
Purity	Beginning stocks <sup>2</sup>	Receipts	Consumption	Ending stocks <sup>2</sup>
<b>1978:</b>				
97.0%-99.9% -----	8	104	4	108
99.99% -----	7	20	13	14
99.999% -----	4	60	59	5
99.9999%-99.99999% -----	1,525	9,169	8,832	1,862
<b>Total -----</b>	<b>1,544</b>	<b>9,353</b>	<b>8,908</b>	<b>1,989</b>
<b>1979:</b>				
97.0%-99.9% -----	108	5	7	106
99.99% -----	15	34	45	4
99.999% -----	5	70	72	3
99.9999%-99.99999% -----	1,748	9,101	9,337	1,512
<b>Total -----</b>	<b>1,876</b>	<b>9,210</b>	<b>9,461</b>	<b>1,625</b>

<sup>1</sup>Consumers only.<sup>2</sup>Ending stocks for 1978 do not equal 1979 beginning stocks because of reported beginning stock adjustments.

## STOCKS

Consumer stocks of gallium metal at yearend 1978 and 1979, both commercial and high-purity grades, are shown in table 3.

## PRICES

Throughout 1978, the American Metal Market quoted prices for metal of 99.9999% purity at \$500 to \$600 per kilo in 100-kilogram lots. At the end of 1979, the price

was quoted at \$510 per kilogram in 100-kilogram lots. Gallium prices are subject to negotiation between buyer and seller.

## FOREIGN TRADE

Data on the export of gallium metal and compounds are not reported separately but are included in the export category "base metals and alloys, not elsewhere classified, wrought or unwrought, waste and scrap." Significant quantities of gallium and gallium compounds are exported as parts of manufactured gallium-based electronic and electrical components and equipment.

Imports of gallium in 1978 and 1979 increased substantially in quantity and value from those of 1977 and augmented the U.S. supply available for consumption. In both years, Switzerland was the major source of imported metal. The average value of imported metal declined from \$430.51 per kilogram in 1977 to \$415.28 in 1978 and increased to \$417.37 in 1979.

Table 4.—U.S. imports for consumption of gallium  
(unwrought, waste and scrap), by country

Country	1978		1979	
	Kilograms	Value	Kilograms	Value
Canada	75	\$32,608	450	\$203,431
Czechoslovakia	—	—	53	16,201
Germany, Federal Republic of	748	339,806	218	85,716
Hungary	37	13,629	59	17,526
Italy	—	—	—	—
Japan	100	31,500	41	22,452
Netherlands	—	—	41	17,180
Switzerland	2,628	1,082,700	5,498	2,289,820
United Kingdom	133	45,023	41	19,228
Total	3,721	1,545,266	6,401	2,671,554

## WORLD REVIEW

Data on world consumption and production of gallium are not available. However, significant quantities of gallium metal and compounds are probably consumed by countries with large, well-developed electronic

and electrical industries. Based on 1978 and 1979 U.S. imports of gallium, the rest-of-world gallium production probably increased significantly.

## TECHNOLOGY

A solar cell was described that converts sunlight into electricity with a 28.5% conversion efficiency. A mirror focused solar energy on a special filter that splits incoming light waves into low-energy long light waves and high-energy short light waves. The lower energy waves are directed to a silicon cell, and the high-energy waves pass through the filter to an aluminum-gallium arsenide conversion cell. Conversion efficiency was improved because the two-cell system used a wider range of light energy.<sup>2</sup>

A recent paper reviewed the supply-demand situation for gallium and also

discussed recovery technology.<sup>3</sup>

Gallium extraction from an alkaline aluminate solution obtained from the recovery of aluminum from nepheline ore was described.<sup>4</sup>

<sup>1</sup>Physical scientist, Section of Nonferrous Metals.

<sup>2</sup>The Energy Daily. Efficiency Breakthrough. V. 6, No. 132, July 11, 1978, p. 4.

<sup>3</sup>Rosi, F. D. A Survey of the Market, Supply and Availability of Gallium. University of Va., Charlottesville, Va. Oct. 1, 1979, 35 pp.

<sup>4</sup>Badaliant, K. A., et al. Extraction of Gallium From an Alkaline Aluminate Solution Formed in the Extraction of Aluminum From Nepheline Ore. U.S. Pat. 4,152,227, May 1, 1979, 10 pp.

