12.12 Secondary Magnesium Smelting

12.12.1 General[1,2]

Secondary magnesium smelters process scrap which contains magnesium to produce magnesium alloys. Sources of scrap for magnesium smelting include automobile crankcase and transmission housings, beverage cans, scrap from product manufacture, and sludges from various magnesium-melting operations. This form of recovery is becoming an important factor in magnesium production. In 1983, only 13 percent of the U. S. magnesium supply came from secondary production; in 1991, this number increased to 30 percent, primarily due to increased recycling of beverage cans.

12.12.2 Process Description[3,4]

Magnesium scrap is sorted and charged into a steel crucible maintained at approximately 675°C (1247°F). As the charge begins to burn, flux must be added to control oxidation. Fluxes usually contain chloride salts of potassium, magnesium, barium, and magnesium oxide and calcium fluoride. Fluxes are floated on top of the melt to prevent contact with air. The method of heating the crucible causes the bottom layer of scrap to melt first while the top remains solid. This semi-molten state allows cold castings to be added without danger of "shooting", a violent reaction that occurs when cold metals are added to hot liquid metals. As soon as the surface of the feed becomes liquid, a crusting flux must be added to inhibit surface burning.

The composition of the melt is carefully monitored. Steel, salts, and oxides coagulate at the bottom of the furnace. Additional metals are added as needed to reach specifications. Once the molten metal reaches the desired levels of key components, it is poured, pumped, or ladled into ingots.

12.12.3 Emissions And Controls[5,6]

Emissions for a typical magnesium smelter are given in Tables 12.12-1 and 12.12-2. Emissions from magnesium smelting include particulate magnesium oxides (MgO) and from the melting and fluxing processes, and nitrogen oxides from the fixation of atmospheric nitrogen by the furnace temperatures. Carbon monoxide and nonmethane hydrocarbons have also been detected. The type of flux used on the molten material, the amount of contamination of the scrap (especially oil and other hydrocarbons), and the type and extent of control equipment affect the amount of emissions produced.

Table 12.12-1 (Metric Units). EMISSION FACTORS FOR SECONDARY MAGNESIUM SMELTING

Type of Furnace	Particulate Emission Factor[a]	EMISSION FACTOR RATING
Pot Furnace (SCC 3-04-006-01)		
Uncontrolled	2	C
Controlled	0.2	C

[a] References 5 and 6. Emission factors are expressed as kg of pollutant/Mg of metal processed. SCC = Source Classification Code.

Table 12.12-2 (English Units). EMISSION FACTORS FOR SECONDARY MAGNESIUM SMELTING

Type of Furnace	Particulate Emission Factor[a]	EMISSION FACTOR RATING
Pot Furnace (SCC 3-04-006-01)		
Uncontrolled	4	C
Controlled	0.4	C

[a] References 5 and 6. Emission factors are expressed as lb of pollutant/ton of metal processed. SCC = Source Classification Code.

References For Section 12.12

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2. *Mineral Commodity Summaries 1992*, Bureau Of Mines, Washington, DC.

3. *Light Metal Age*, "Recycling: The Catchword Of The ’90s", Vol. 50, CA, February, 1992.

4. *National Emission Inventory Of Sources And Emissions Of Magnesium*, EPA-450 12-74-010, U. S. Environmental Protection Agency, Research Triangle Park, NC, May 1973.

5. G. L. Allen, *et al*., *Control Of Metallurgical And Mineral Dusts And Fumes In Los Angeles County*. Department Of The Interior, Bureau Of Mines, Washington, DC, Information Circular Number 7627, April 1952.

6. W. F. Hammond, Data On Nonferrous Metallurgical Operations, Los Angeles County Air Pollution Control District, November 1966.