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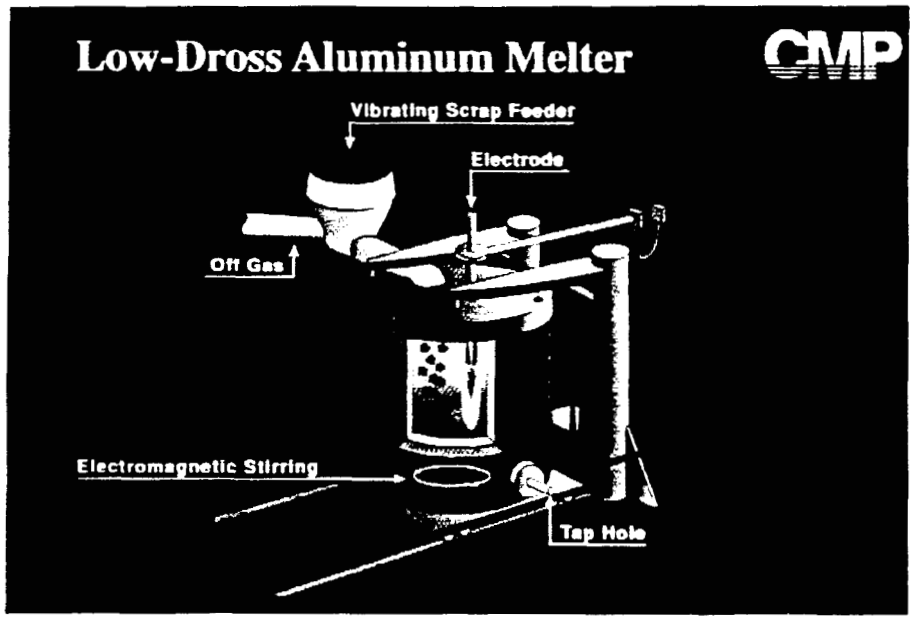

CMP DEVELOPS LOW-DROSS ALUMINUM MELTER TO INCREASE ELECTRICITY MARKET SHARE

"With the development of the Center for Materials Production (CMP) Low-Dross Aluminum Melter, the electric utility industry now has a technology superior to that of gas-fired reverberatory aluminum melting furnaces. This new plasma technology will allow electric utilities to increase kWh sales as old inefficient gas reverberatory furnaces are replaced with new energy efficient electric plasma aluminum melters."

■ **Chris Santho**
Centerior Energy

BENEFITS

■ **Aluminum melting offers an electrical load growth potential of 18 billion kWh annually.**

■ **The low-dross aluminum melter offers thermal efficiency of 70% compared to gas-fired furnaces of 20%.**

■ **A small amount of argon gas is fed to the furnace to create an inert atmosphere which eliminates the need for covering the molten bath with a flux, which has been standard practice in the industry. This fluxless melting approach will significantly reduce the amount of material requiring disposal in landfills and lower operating costs.**

■ **Higher yields (low-metal loss) are obtained with this melter compared to gas-fired reverberatory furnaces. Up to 99% of the aluminum contained in the scrap feed can be recovered compared to 90 to 95% for gas melting.**

■ **A unique feature of this melter is that when not melting aluminum it can process the dross from this and other furnaces. An inert oxide by-product is produced which can be sold to the steel industry. Gas-fired melters don't offer this dual capability.**

■ **The high melting rate and small furnace volume allow fast start-up and shut-down of the melter, giving it process flexibility. A gas-fired reverberatory furnace takes a long time to heat up or cool down.**

■ **Off-gas rates are reduced by 90% in the plasma melter, which greatly simplifies the off-gas system. The furnace is environmentally friendly, operating quietly and with negligible fugitive emissions.**

Challenge

About eight million tons of aluminum are melted annually in the United States by the primary and secondary aluminum industries. Approximately 50% is remelted and 50% is used directly from smelters. Nearly 90 percent of the melting furnaces are gas-fired, particularly the large reverberatory type furnaces. Neither electric resistance nor induction melting furnaces can compete effectively with large gas-fired reverberatory melters. The major drawback to electric resistance reverberatory melters are longer melt times, no stirring action and element breakage. Although induction melting overcomes these disadvantages, high initial cost, as much as four times the cost of an electric resistance or gas-fired reverberatory furnace, deters the sale of these melters.

Response

Recognizing the need for a new electric melting technology to more effec-

Response

Continued from other side

tively compete with gas melting, The EPRI Center for Materials Production funded studies with Process Engineering Dynamics (PED) to develop an aluminum melter that offers high thermal efficiency, fast start-up, low metal loss, stirring action, and can also process dross. PED developed the dc plasma arc aluminum melter referred to as the "CMP Low Dross Aluminum Melter." Working with Centerior Energy, CMP organized a collaborative project to fund the engineering, construction, and evaluation of a commercial size melter at Wabash Alloys in Cleveland, Ohio, a customer of Centerior. Funding for the project was provided by EPRI/CMP, Centerior, Southern Services, TVA, American Electric Power, and Southern California Edison. Also, cost sharing was provided by Wabash and Praxair.

The melter is best operated in a continuous feed mode. Scrap is continuously fed through an inert gas curtain in the roof of the furnace. An electromagnetic stirring coil forces the molten aluminum to move tangentially within the furnace, bringing the scrap under the argon plasma heat source. The graphite electrode position is automatically controlled by hydraulic movement to maintain arc voltage, and the current is regulated by the DC power supply. The capacity of the furnace is only twice the hourly melt rate, so intermittent operation or frequent alloy changes are practical. The furnace may be continuously or intermittently tapped leaving a molten "heel" into which scrap is feed.

Refractory erosion is much less than with conventional gas-fired melters, since exothermic aluminum oxidation is prevented and no salt flux is used. The dross production is minimal but when dross accumulates, it can be removed by lifting the furnace lid and using conventional dross removal techniques. The dross is saved for periodic processing to recover contained aluminum and to produce a molten oxide by-product for sale to the steel industry. Melter size can be varied from a few hundred pounds to several tons, depending on process requirements.

Economic Analysis of Centerior Energy's Application

- Melt losses for loose scrap can be reduced by at least 50% over that for gas-fired melting, so yield improvement alone will pay for the melter in less than a year.
- Energy costs are higher than that of a gas-fired reverberatory furnace, but this is more than offset by the dramatic increase in yield.
- Dross can be processed in the furnace thereby eliminating disposal costs. Further, when processing dross the contained aluminum is recovered and a by-product produced that can be sold to the steel industry.
- Salt flux normally used in melting with gas can be eliminated, further reducing cost.
- When the costs and benefits are compiled, an average savings of $0.01/lb. conversion cost is projected, potential savings to the industry in melting 4 million tons per year is $80 million.
- At 450 kWh/ton aluminum melted, there is a potential 1.8 billion kWh of additional load. Even if only 10% of this is realized in the next several years, the additional load is very significant at 180 million kWh.
- Capital cost for a 10,000 lb. per hour melter is estimated at 1.2 million dollars.
- The low-dross aluminum melter occupies only 25% of the floor area of the equivalent reverberatory furnace, providing the potential for increased capacity without increasing building requirements.

Reference

- DC Plasma-Arc Process for Melting Aluminum and Processing Dross, CMP Report No. 91-8.

Publications are available from ECAC at 1-800-4320-AMP.

Commercial Availability

The CMP Low-Dross Aluminum Melter can be purchased from:

Process Engineering Dynamics, Inc.
22 Trails End, Grand Island, NY 14072
Phone USA: (716) 774-1393
Toronto: (416) 622-9279

For further information, contact:

Electric Power Research Institute
P.O. Box 10412, Palo Alto, CA 94303

Preston Roberts, Manager
Materials Production and Fabrication
Industrial, Agricultural, and Large Commercial Business Group
(610) 861-5367

Robert Schmitt, Associate Director
Center for Materials Production
(412) 268-6442

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