Oxygen-Enhanced Melting of Aluminum

Praxair has developed and commercialized several proprietary oxygen-injection techniques and oxy-fuel combustion systems that enhance the productivity and efficiency of aluminum melting furnaces.

These technologies improve the effectiveness of furnace combustion by reducing the undesirable impact of inert nitrogen from the air on these processes. Oxygen injection increases the heat available in the furnace for melting by reducing the heat loss due to hot nitrogen in the flue gas. Oxygen injection also improves the heat transfer from the products of combustion to the load by reducing the adverse influence of nitrogen on heat transfer characteristics of the furnace gases.

Oxygen can be added as enrichment by mixing it with the combustion air or lancing it into the furnace. Or it can completely replace the combustion air, converting an air-fuel process to an oxy-fuel process.

### FEATURES

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<th>FEATURES</th>
<th>BENEFITS</th>
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<td>Increased Productivity</td>
<td>Oxygen injection can be used to boost the productivity of both reverberatory and rotary furnaces. In typical operations, the melt rate can be increased significantly by injecting oxygen. Oxygen injection has achieved gains of greater than 50% in melt rate. Further increases in melt rate are possible with conversion to full oxy-fuel combustion.</td>
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<td>A second key benefit to oxygen enhanced combustion is a significant reduction in the specific fuel requirement. The magnitude of the fuel savings depends on the inlet air temperature, flue gas temperature, oxygen content of the oxidant gas, and the operating practices of the furnace.</td>
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<td>Emissions</td>
<td>Full oxy-fuel conversion also provides improved emissions performance in two ways. First, removing most of the nitrogen from the furnace dramatically reduces NOx generation and with Praxair’s DOC technology, NOx emissions are minimized. Additionally, oxygen promotes complete combustion of any volatile organic compounds (VOCs) that may be present from feed materials. Care must be taken in designing oxygen enhanced combustion systems to control flame temperatures to limit thermal NOx generation.</td>
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<td>Other Benefits</td>
<td>Oxygen has been successfully added to aluminum furnaces without any loss of yield or incremental refractory wear.</td>
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Applications
Praxair provides several different combustion systems to the aluminum industry to meet customer-specific needs. Praxair’s patented OPTIFIRE™ JL burner is used commercially in oxy-fuel combustion in reverberatory furnaces.

Non-stationary flame oxy-fuel burners are also available for maximization of melt rate with significant dross reduction. Additionally, Praxair supplies proprietary lance designs for lanced injection of oxygen either through an existing air-fuel burner or through an additional furnace penetration.

Results
Praxair is an industry leader in developing oxy-gen-based combustion technologies for steel and non-ferrous metals manufacturers. Praxair offers several combustion technologies to aluminum melters to improve the overall cost-effectiveness of plant operations. These include oxygen boosting by lancing oxygen to improve the efficiency of existing air-fuel combustion systems, and full oxy-fuel conversion of air-fuel combustion systems. Praxair has successfully commercialized oxygen-based systems in reverberatory and rotary furnaces worldwide. Results from oxy-fuel conversions of aluminum furnaces are summarized below:

Reverberatory Furnaces
- >70 conversions (up to 160 tons)
- >100% melt rate increase
- Up to 50% specific fuel savings

Benefits achieved depend strongly on site specific factors. Contact Praxair today to learn more about your oxygen-enhanced combustion options.

Rotary Furnaces
- >40 conversions (tilting & fixed axis of up to 65 tons)
- 25 – 50% faster melting
- 20 – 60% specific fuel savings

Oxygen Supply Systems
Praxair can supply oxygen when you need and where you need it. Whether you need cylinders, liquid oxygen supply or an on-site air separation unit, we work with our customers to determine the most cost-effective supply option based on the customer's needs and anticipated use pattern. For liquid oxygen supply, our bulk and microbulk delivery systems provide uninterrupted supply of gases and liquids for your business. For producers with long-term needs and with stable use patterns, on-site generation is often the most cost effective option.

For more information, contact us at 1-800-PRAXAIR or visit us at www.praxair.com/metals.