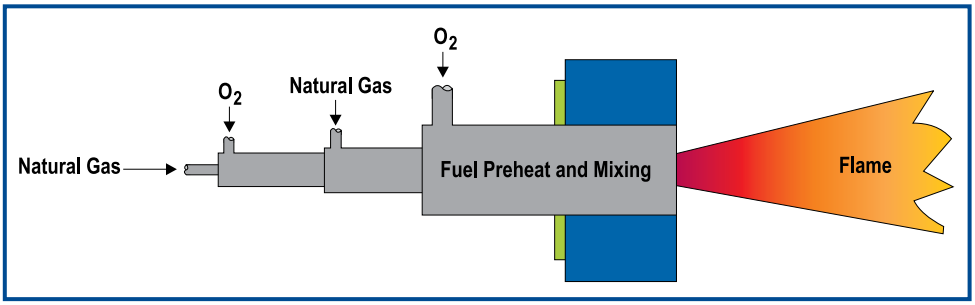
High-Luminosity, Low-NOx Burner

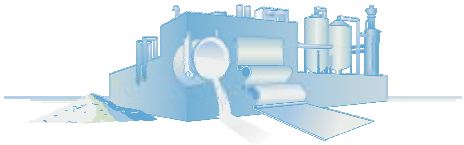
High-Efficiency Burner Lowers Costs and Emissions in Oxyfuel Glass Melters

While significant progress has been made in developing oxyfuel combustion systems, current technologies provide low flame luminosity which limits increases in production rates and thermal efficiency. These technologies also generate relatively high NOx emissions in the presence of even small amounts of nitrogen (derived from air infiltration, N_2 in natural gas, oxygen, or feedstock).

To address these issues, the Gas Technology Institute worked with Combustion Tec and Owens Corning to develop a high-luminosity, low-NOx oxygen/natural gas burner. This burner increases luminosity and radiant heat transfer by modifying the fuel prior to combustion and then forming and burning soot in the flame. Increasing heat transfer rates while decreasing flame temperatures results in increased furnace production rates and thermal efficiency.



The unique preheating/combustion design of the high-luminosity, low-NOx burner will increase production rates and thermal efficiency.



Benefits for Our Industry and Our Nation

- Increase of up to 20 percent in thermal efficiency
- Extended furnace life due to lower flame and exit temperature
- Reduced NOx emissions (up to 50 percent)
- Reduced production costs—the burner provides cost-effective compliance with emissions regulations. Additionally, existing furnaces can be retrofitted without major modifications

Applications in Our Nation's Industry

This novel burner can be used in all existing and new oxyfuel glass melters. Although the largest demand currently exists in the container, fiber, and specialty glass sectors of the glass industry, applications may also exist in other energy-intensive industries.

Project Description

Goal: Develop an improved oxyfuel burner system for use in high-temperature glass furnaces that will increase thermal efficiency while reducing energy consumption and NOx emissions.

The high-luminosity, low-NOx burner combines a preheating zone with two combustion zones. First, a small fraction of the natural gas is burned. The products of this combustion are mixed with the main supply of natural gas, resulting in hydrocarbon soot precursors generated in an oxygen-free heating environment. The preheated natural gas then enters the first, fuel-rich combustion zone in which soot forms in the flame. The majority of the combustion, however, occurs in the second, fuel-lean combustion zone. The burning soot particles create a highly luminous flame that is more thermally efficient and cooler than a typical oxyfuel flame.

Progress and Milestones

Laboratory testing at 0.5 MM Btu/h demonstrated an increase in heat transfer of more than 12 percent to an artificial load.

Demonstration testing at 2.25 MM Btu/h confirmed a predicted increase in heat transfer and luminosity.

Commercial testing of the burner system on an oxyfuel fiberglass furnace was conducted in 2001 and 2002. The project ended in 2002. Subsequently, this technology was demonstrated at PPG Industries beginning in 2002 under a grant from the DOE NICE[3] program. The technology is commercially available for purchase from Combustion Tec (now part of Eclipse).

Project Partners

Combustion Tec, Incorporated
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Gas Technology Institute
Des Plaines, IL

Owens Corning
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