Coke Savings and Other Benefits of Oxygen Use in Cupolas
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Introduction
The cupola melting process has been modified over the years to improve efficiency and reduce coke consumption. Modifications have included building larger diameter cupolas, better insulation, designing for longer campaigns, the introduction of hot blast and oxygen enrichment. Today, these enhancements are standard practice in many foundries.

Coke is the fundamental fuel for cupola operations that performs the vital task of providing the energy and bed structure essential for a cupola to operate. Therefore, if alternative fuels are to be used, they must be used in conjunction with a coke bed or some other structure. The main challenge with using a fuel such as natural gas is that when burned in air, the flame temperature is not high enough to enable sufficient heat transfer for the required metal temperature. The combustion zone of the cupola itself can approach the temperature of the air/natural gas flame, making heat transfer virtually impossible. The solution is to burn the natural gas in the presence of pure oxygen to produce a much higher flame temperature. This provides a large enough heat gradient between the natural gas combustion products and the coke bed/combustion zone to allow heat transfer to take place at an efficient rate. The addition of oxygen/natural gas burners in selected tuyeres allows the cupola operator to combine the best features of coke, natural gas and oxygen to give a wide range of practical benefits. Due to the high cost of coke today, advanced oxygen technologies are increasingly attractive to more and more foundries.

Solutions to help you advance
Air Products has developed a wide range of technologies to meet our customers’ specific needs from general enrichment, to supersonic tuyere injection, to our APCOSTM oxy-fuel technology with the option of solids injection. By using oxygen, you can achieve higher production rates, lower coke usage, increased efficiency of alloy additions and overall lower melting costs. The best technology for you depends on many aspects, such as your existing cupola operating parameters, goals and current market conditions. Therefore, it’s very important to work with a company that has a broad range of proven technologies.

Our APCOS oxy-fuel technology has been applied to several cupolas in Europe with various operating modes. The benefits include production increase, coke savings, alloy powder injection and greater operating flexibility.
A key component of our technology is a proprietary burner and control system designed to simultaneously inject natural gas, oxygen, and optional solid wastes (e.g. dust, fines, coke breeze, etc.) and/or metallurgical powders through cupola tuyeres. Injection of solid particles into the cupola is not a new concept—in 1831 an English patent describes adding coal and other materials to a blast furnace. Other materials such as silicon, cupola ash, coal dust and sweepings have been introduced to the cupola. In most cases it was necessary to blow the material into the cupola intermittently because of operational problems caused by cooling at the tuyere while operating at higher injection rates. Air Products developed the APCOS technology to counter this cooling effect by adding additional energy in the form of natural gas combustion with pure oxygen. High oxygen concentrations together with high temperature also provide excellent conditions to beneficially combust any fuel components contained in the solids. This heat can only be provided by an oxy-fuel burner, because only an oxy-fuel flame temperature is able to deliver significant heat flux into the high temperature melt zone.

The Air Products APCOS oxy-fuel system can be tailored to address the individual needs of each foundry. Through our technology, you can achieve substantial coke savings, lower carbon dioxide emissions, increase melt rate and the ability to inject solids. Dual fuel ability also gives you the flexibly to react to uncertain and rapidly changing coke prices.

To learn how our system can help you increase production, achieve coke savings, solids injection and greater operating flexibility; give us a call at 800-654-4567.

For more information

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