



**SOLUTIONS TO BLAST FURNACE
OXYGEN-RICH IRONMAKING
VPSA-O₂**

Overview of Oxygen-Coal Injection Technology in BF Ironmaking

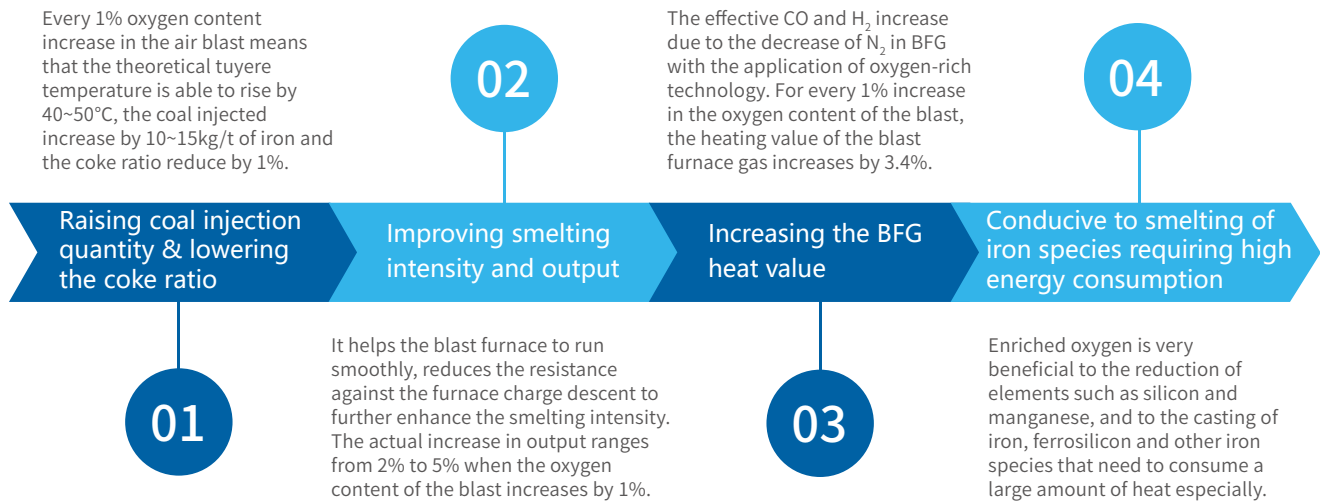
Blast furnace oxygen enrichment technology first appeared in 1960s and coal injection technology was applied in blast furnace ironmaking industry in 1980s.

Ansteel Group conducted its first industrial experiment of oxy-coal injection technology in No.2 blast furnace in 1986, followed by Shougang Group and Bao Steel Co., Ltd., and all these experiments led to remarkable achievements. Blast furnace oxygen enrichment and coal injection technology thence were combined officially and applied to blast furnace smelting as an integrated technology, which achieved rapid development in China.

In the 21st century, pressure swing adsorption (PSA) oxygen generation technology, enriched oxygen injection before the blower and other related technologies developed and helped to reduce the production cost of blast furnace ironmaking, thus allowing the widespread application of blast furnace oxy-coal ironmaking process.



Benefits of Oxygen Enrichment Technology in BF Ironmaking



Application of BF Oxygen Enrichment Technology

There are two ways to provide enriched oxygen for blast furnace-oxygen injection before the blower or after the blower. The commonly-used second method is to depressurize the high-pressure pure oxygen from the air separation plant outlet and then send it to the BF blower rear pipeline where the depressurized oxygen mixes with the air, and then push it into the blast furnace, causing a great waste of energy. While the before-blower one is to directly mix low-pressure oxygen into the suction side of the blast furnace blower, thereby increasing the oxygen content in the blast. According to the relevant data, the power consumption by injecting oxygen before the blower is only 60% of that after the blower.

On the premise that the purity of oxygen entering the blast furnace blower is controlled within a reasonable range, there is no need to modify the BF blower, and only through the addition or adjustment of pipes, valves, and air distributors, oxygen injection before the blast furnace can be achieved. At present, many iron and steel enterprises have adopted or transformed the before-blower oxygen injection and achieved substantial economic benefits.



Options of Oxygen Generation Technologies

Currently, the most widely used oxygen generation technologies in the industrial field are pressure swing absorption (PSA) oxygen generation and cryogenic air separation. From the perspective of manufacturing practice, cryogenic oxygen generation can produce high-purity oxygen, nitrogen and chlorine, making it a necessity for long-process steelworks. In comparison, the outstanding advantage of PSA oxygen generation technology is the low operating cost, but the product is only enriched oxygen suitable for blast furnace oxygen enrichment. It has

been used as a supplement and adjustment for steel enterprises for a long time.

In recent years, with the rapid development of PSA oxygen generation technology, particularly the breakthrough of radial adsorber technology, the capacity of complete sets of oxygen system has reached 70,000 Nm³/h (100%). The low cost and easy load adjustment of PSA oxygen generation make it a trend to equip blast furnaces with specialized oxygen plants.

Oxygen Generation Technologies Comparison

ITEMS	PSA	CRYOGENIC
Power Consumption	Low	High
Purity	60%~93%	99.6%
Load Regulation	0-100%	75-100 %
Start-up & Turn-down Time	15-20 min	120 Min-240 min
Equipment Type	Normal-Temperature & Low-Pressure	Low-Temperature & High-Pressure
Equipment Quantity	Simple & Less Devices	Complex & More Devices
Maintenance & Management	Routine Maintenance, Unattended Operation	Professional High-Cost Maintenance Team Needed
Construction Period	Short	Long
Unit Oxygen Cost	Low	High
<p>Conclusion: PSA oxygen generation has prominent advantages and can meet following demands:</p> <ol style="list-style-type: none"> 1. Exclusive oxygen generating system for blast furnace 2. Adjusting tool for gas balance of entire factories 		

About PKU PIONEER

Founded in 1999, PKU PIONEER is a high-tech enterprise affiliated to Peking University. We specialize in the design and manufacture of PSA gas separation technology and complete sets of equipment, related adsorbents and catalysts. Up to now, PKU PIONEER has provided more than 200 sets of PSA oxygen plants for customers in various industries such as steel, non-ferrous metallurgy, etc. With high-ranking performance

indicators and reliable operation, our PSA oxygen plants have won unanimous compliments from the clients and become the leader brand in PSA oxygen generation industry. We will continue to uphold the tenet of "Exploitation, Innovation, Satisfaction, and Improvement", and wholeheartedly provide users in various areas with reliable products and quality services.

Cases in Steel & Iron Industry

As of 2021, PKU PIONEER has built more than 50 sets of PSA oxygen units in the iron & steel industry, creating considerable economic returns for the customers.

In 2016, PKU PIONEER provided a ZO-15000/92 PSA oxygen plant for the blast furnace technological upgrading project of JSW, India's second largest private sector steel company, thus setting a new record for China's export of PSA oxygen generating equipment. Adopting oxygen injection before the blower, the oxygen enrichment rate climbs to 3-5% while the molten iron output increases by 10-20% and the coal ratio by about 35kg/t of iron.

From May 2018 to December 2020, JSPL, a subsidiary of India's largest steel mill and PKU Pioneer successively signed the contract for the blast furnace iron-making oxygen production project (4 phases). The total capacity of the PSA oxygen production plant reached 36,000Nm³/h, which equals approx. 1200TPD liquid oxygen. All the oxygen plants realized standard production, providing rich oxygen for JSPL blast furnaces, which greatly saves ironmaking costs and improves the iron output and economic benefits. PKU PIONEER is the oxygen equipment supplier exporting the most PSA-O₂ plants with the largest oxygen capacity to India.