

Oxygen combustion technologies

SIAD S.p.A. designs and builds water cooled as well as non water cooled oxy-fuel burners, for any specific range of heating capacity and type of combustibles.

Our burners are studied to accomplish customized melting processes and we adapt the flame shape and its length to the furnace.

To date we have installed our oxy-fuel burners for:

- gold and silver scraps melting;
- precious metals recovery from computer scraps;
- copper and its alloy melting;
- aluminum recovery from scraps and dross;
- lead recovery from battery scraps;
- cast iron melting;
- tin dross recovery;
- nickel and its alloys melting;
- glass melting;
- frits melting;
- pigments production;
- ceramic tiles production;
- glass polishing;
- rockwool production.

Moreover we have implemented the combustion efficiency of air burners, applied in copper melting shaft furnaces, inserting our oxy-fuel burners into the main air burners obtaining a stable and hotter flame, controlling the combustion kinetics and the gases generated into the furnace.

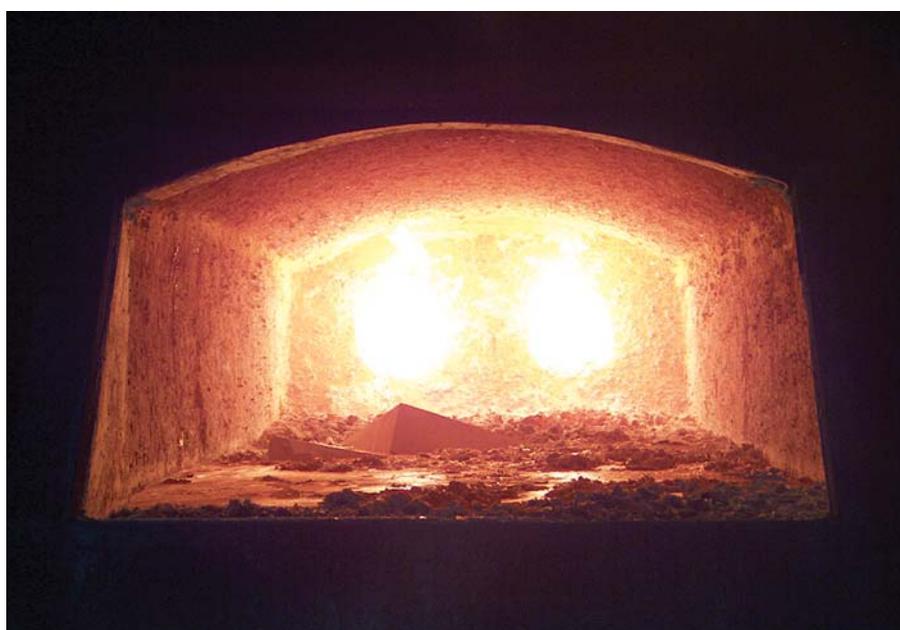


Frits melting furnace



Crucible melting furnace

We don't supply only oxygen and oxy-fuel burners, but their application technology!



Oxy-fuel burners in aluminum reverberatory melting furnace

Oxy-fuel burners



Aluminum reverberatory melting furnace

In rotary furnaces

The technical and economic requirements for greater thermal efficiency in rotary melting kilns, to modernize their industrial employment, has directed the technical research to the study of combustion process in pure oxygen.

As a result, SIAD has developed a range of oxy-fuel burners which has been successfully applied to melting furnaces for the recovery/melting of metals.



Cast iron rotary kiln

The substitution of conventional air burners by oxy-fuel burners has had a positive effect on the overall results of melting units and the advantages obtained can be resumed as follows:

- reduced melting costs;
- reduced melting time;
- reduced off-gases volume;
- more operating flexibility;
- less metal's oxidation;
- better separation between slag and metal.

In reverberatory furnaces

Our oxy-fuel burners have found many applications in the glass, frits and aluminum industries. In particular, in frits production, they have produced an important quality improvement in the design and construction of the melting furnaces, as well as reductions in costs and off-gas volumes.

In glass and aluminum melting furnaces, oxy-fuel burners are used for assisted melting in transferring high quality energy to critical points in the furnace thus increasing the specific production per m² and giving new life to the furnace itself.



Oxy-fuel burner in cast iron rotary melting furnace

The oxy-fuel units

The main components of any oxy-fuel unit are:

- oxygen and fuel gas control panel for measuring, controlling and regulating the flows of the fluids;
- the electric control panel with PLC control system;
- the burner(s): the best operating results depend on the exact choice of the burner(s) according to the melting furnace;
- the structure, if necessary, for the movement of the burner.

In designing the oxy-fuel unit, all the indispensable technical and safety standards, have been employed, resulting in:

- pilot burner with automatic ignition and ionic flame detection;
- U.V. flame detector for the oxy-fuel burner;
- check valves at burner gas connections;
- control system for minimum and maximum flows of oxygen and fuel;
- automatic regulation valves provided with electropneumatic actuator to regulate flows of oxygen and fuel;
- fluid interception with vent valves;
- automatic purging system;
- flow and temperature control of cooling water, if used;
- refractory blocks specifically designed for the burners.



Oxy-fuel unit for rotary melting furnace

Particular care has been taken in the selection of instantaneous oxygen and fuel measuring devices so as to obtain a high degree of precision together with constant and reliable operation.

In design these combustion units SIAD has taken great care concerning the reliability of each component together with the strength of the structure, which assures:

- maximum operating safety;
- simplicity of operation;
- low noise level;
- reduced maintenance.



Oxy-fuel unit for aluminum reverberatory melting furnace

The advantages of oxygen combustion

In the combustion process, air and fuel combine to form CO_2 and H_2O as main reaction products. The N_2 contained in air ($\approx 79\%$ in volume) doesn't participate in the reaction and its presence limits the energy transferred to the "system". In particular there are energy losses due to the hot gases leaving the furnaces. Nitrogen is also inefficient to heat transfer by radiation so its efficiency in energy transfer is very limited.

By enriching the combustion air with oxygen the concentration of nitrogen is linearly reduced and the effects on the combustion characteristics are:

- higher flame temperature (see figure 1);
- increased concentration of high energy radiating gases (H_2O and CO_2);
- higher flame speed;
- lower ignition temperature;
- wider flammability range;
- lower energy losses from hot gases leaving the furnace (see figure 2).

Benefits of oxygen combustion are:

- productivity improvement;
- higher melting rate;
- fuel savings;
- less fumes emitted;
- less particulates into the fumes;
- lower VOC concentration in the fumes.

The development of combustion processes in oxygen enriched air has led to the study of pure oxy-fuel burners. The oxy-fuel burners can completely replace the air-fuel ones or they can be integrated with the traditional combustion systems to improve the efficiency of existing furnaces. Each SIAD's burner is built to the customer's specific needs to obtain the expected results for the application considered.

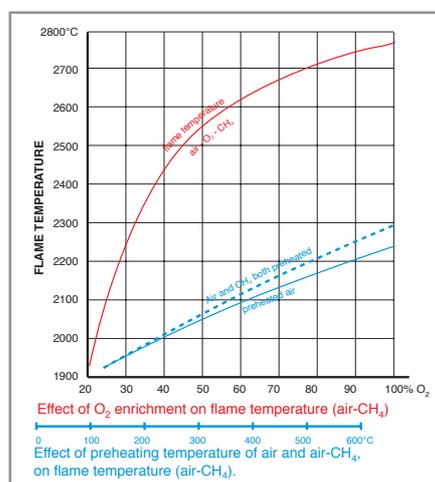


Fig. 1: Flame temperature in relation to oxygen percentage in the combustion atmosphere, compared to the flame temperature in air preheated and air-natural gas preheated system.

For the design and the construction of the SIAD's burner unit, the safety and the way to use together with adequate choice of the components for their reliability are of primary importance.

SIAD's burners are equipped with ignition devices (electrical sparks or pilot burner) and flame detection device.

The fuel most widely used today is Natural Gas, but in case of need we design burners for oil, using atomizing lances.

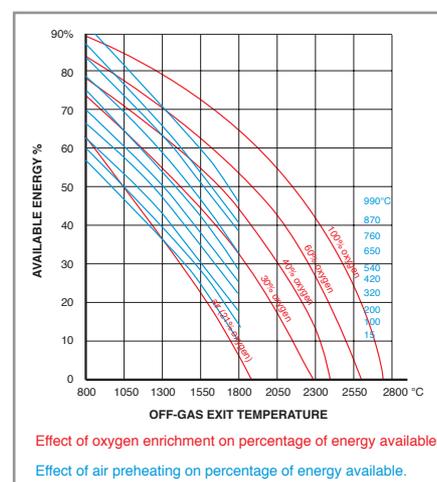


Fig. 2: Energy available to the process as function of the temperature of the exhaust gases. In oxygen enriched combustion process and in air preheated system.



On the left, oxy-gas burner for glass polishing

On the right, Air/ O_2 /Natural Gas Flame

Our oxygen applications

SIAD is one of the most important manufacturers of industrial gases in Europe as well as leader in technological development of combustion engineering and we develop technologies for:

OXYGEN USE IN INDUSTRIAL COMBUSTION PROCESSES

	Oxy-fuel burners	Post-combustion	Lancing	O ₂ Enrichment
Cast iron Cupolas and blast furnaces	v	v	v	v
Rotary kiln	v		v	v
Boosting of electric arc furnace	v	v	v	
Copper and its alloys melting	v		v	v
Lead melting	v	v		
Aluminum melting	v	v		
Cement				v
Glass melting	v		v	v
Glass polishing	v			
Frits melting	v			v
Ladle preheating	v			v
Waste incineration	v	v	v	v
Precious metals recovery	v	v	v	v
Thermal recovery of sands	v		v	v

OXY-FUEL BURNERS

Type	Melting furnace	Firing rate min-max MW	Cooling requirements (water)
Flameless	Aluminum reverberatory	0,3 - 3,0	No
Multi layers	Aluminum rotary	2,0 - 10,00	Optional
Multi layers	Rotary Kiln for cast iron	1,0 - 10,00	Yes
Multi layers	Frits	0,2 - 3,0	No
Flat Flame burner	Frits and Glass	0,6 - 3,0	No
Mini multi layer	Precious metals	0,04 - 0,5	No
Oxy - Gas reburning		0,01 - 0,03	No

Gases, technologies and services for industry

Oxygen, nitrogen, argon, carbon dioxide, hydrogen and many many more: whether distilled from the atmosphere through physical processes or recovered by production cycles, gases are fundamental elements of technical progress in this modern era.

From the food to the automobile industries, from chemistry to metallurgy, from metal fabrication to environmental and medical applications, gases are used in all the production processes.

Founded in Bergamo in 1927, SIAD, an international Group, is one of the most important firms in the gases sector: industrial, specialty and medical gases, technology, plants and services all gas-related.

SIAD is present in Italy with a network of strategically placed production, distribution and sales centres and in Europe in twelve different Countries: Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Serbia and Montenegro, Slovakia, Slovenia, Romania, Ukraine and Russia.

The international dimension of the Group, as well as its know-how, has been strengthened even more by the joint-venture with the multinational Praxair, one of the greatest in the gases sector.

SIAD Group is also present in other markets connected with the world of gases: healthcare (homecare and hospital), welding and industrial goods, gas production plants, compressors and automation.

Since 1927, SIAD is driven on by a continuous quest for quality. The results of this constant commitment are the technical precision and the commercial transparency that distinguish the products and services provided and the achievement of ever more ambitious goals.

SIAD was the first to obtain, in the gases sector, the ISO 9001 certification for its quality system for Specialty Gases. Certification progressively extended to all the production sectors and subsidiaries and recently renewed according to the international standard ISO 9001:2000. Since 2001, SIAD has been the first and only Calibration Centre in Italy to be accredited by SIT for the preparation of gaseous mixtures.

Recently, SIAD obtained the ISO 14001 environment certification as well as the OHSAS 18001 - Occupational Health and Safety Management System - certification for its production plant in Osio Sopra, near Bergamo.

Those significant recognitions enhance ever more SIAD's commitment for safety and in developing and perfecting ever new solutions for the environment.



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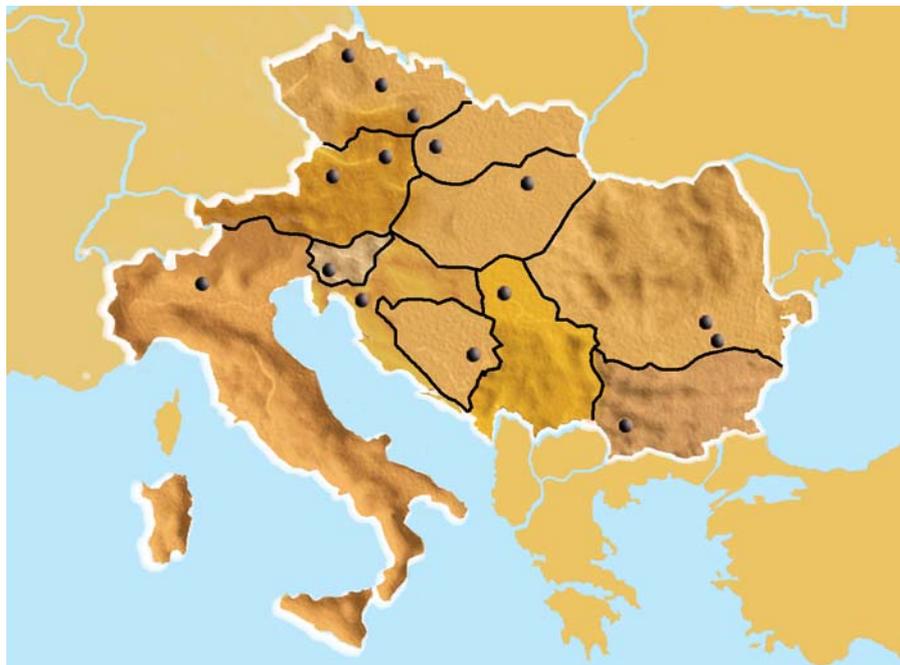
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