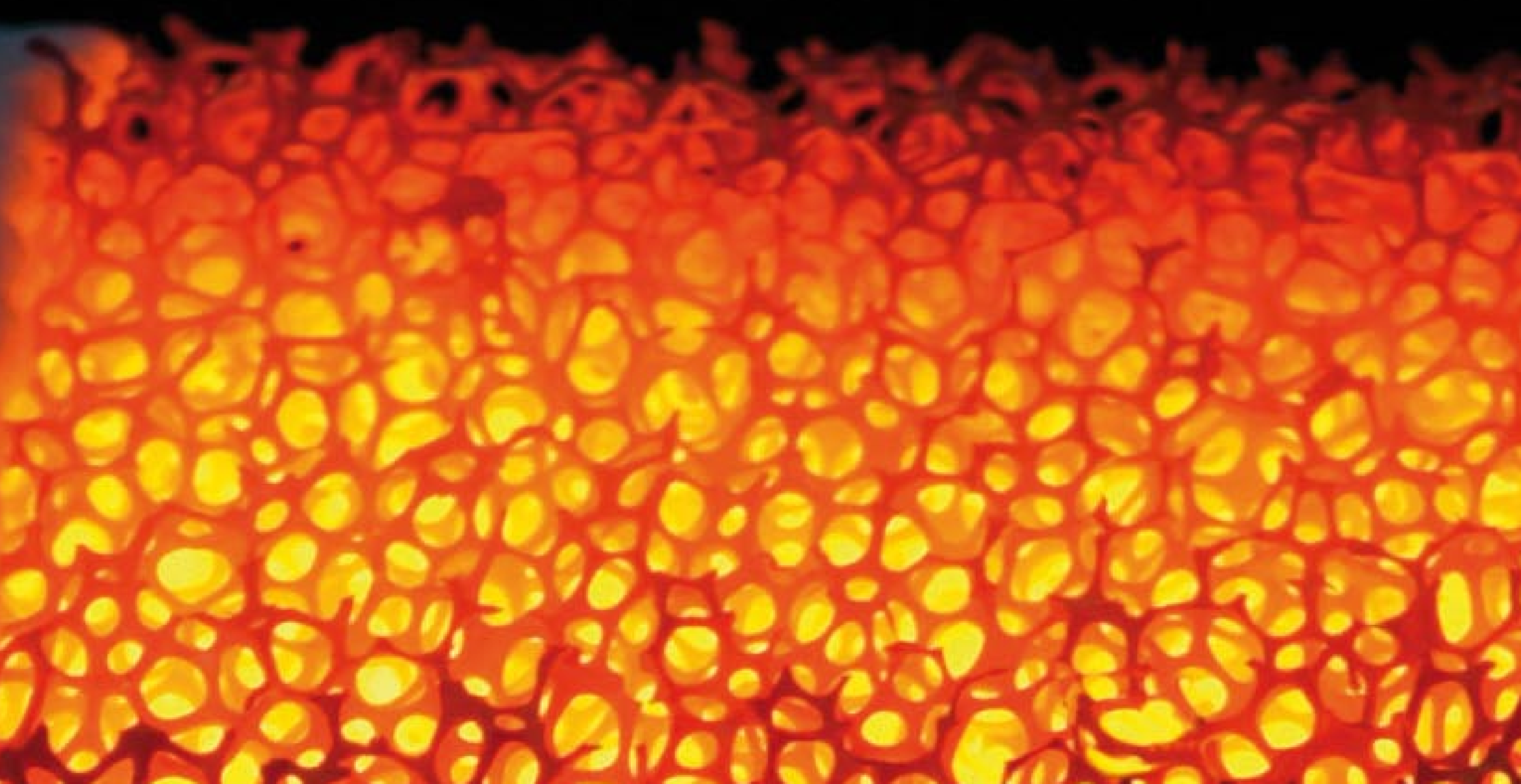
POROUS BURNER TECHNOLOGY ON FOCUS

HIGH POWER DENSITY
PRECISE SCALABILITY
FLEXIBLE SHAPES
MINIMAL EMISSIONS



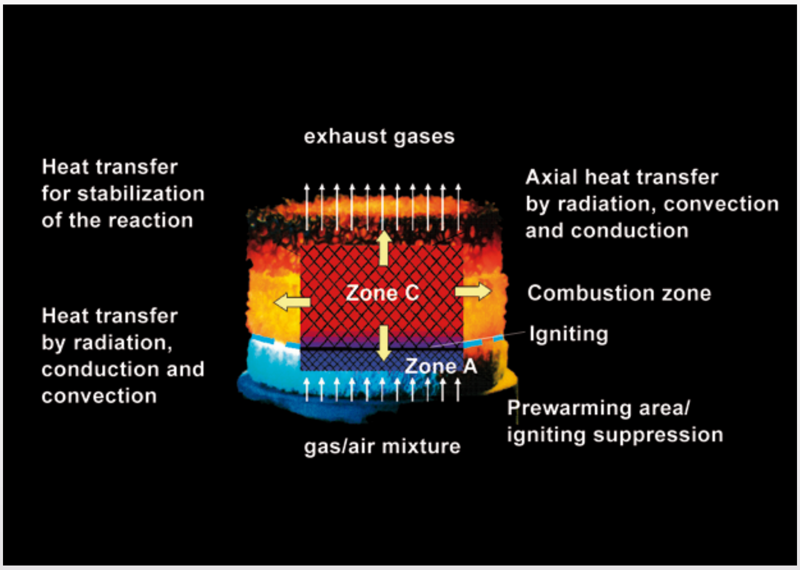
Porous burners, which are also known as volume burners, burn an air/fuel mixture flameless which has previously been mixed within a three-dimensional („volumetric“) porous body, a porous reactor. The porous burner can therefore also be considered as a 3D extension of so-called Surface Burner. This results in a considerable increase in the power density at a significantly greater dynamic range as well as lower emissions over the total output range. In addition, the glowing reactor provides a higher degree of infra-red radiation without creating any flame at the surface – qualities which otherwise are only seen on an electrical radiator.

Porous burners are thus well-suited for many Industrial heating processes, lying as they do between more conventional gas burners and electrical infra-red radiation.

Design of the Porous Burner

The air/fuel mixture which has already been totally mixed is initially lead into a distribution/preheating zone (zone A). This is equipped as a porous plate with a defined structure of holes and prevents the mixture from being prematurely ignited and consequently a premature flashback of the flame.

The combustion is stabilized within the connected Reaction Zone (zone C, Reactor) – the mixture is chemically converted in the pores of zone C, i.e. combusted.



Since a part of the released combustion heat is emitted immediately to the solid body (normally a high-temperature ceramic), which provides a extremely rapid distribution of heat in all directions as a result of the heat conduction and the properties of the solid body, the speed of the combustion can increase by a factor of 100 to 1,000. This produces a flameless, volumetric combustion, which stabilizes exclusively within the large number of small reactors, the pores of the ceramic, regardless of the burner performance, i.e. the mass flow rate of the mixture.

The use of heat can already occur at very short distances to the surface of the porous burner. This gives rise to totally new possibilities for heating objects. The result is, among other things, a significantly more efficient heat transfer on the equipment or in the furnace, not to mention considerable energy savings.

The burning ceramic structure can not only be considered as a surface radiating heat, but also as a constant source of hot air or exhaust gases, which radiate constant heat.

Controlling the Burner

Porous burners can be operated with all conventional burner regulating devices for premixed combustion. There are no further or additional demands regarding operation or safety. Ignition takes place in the normal way by means of an ignition electrode. Heater plugs or glow igniters can also be used in special cases. An ionisation electrode is used, as it is for other burners, for monitoring the flame. Furthermore, UV sensors can be supplied as well as, in special cases, temperature sensors.

The burner performance can be modulated to a ratio of 1:8 with the air-gas linkage, which is now supplied as a standard solution in the heating sector, which by means of a Venturi injector, the gas and air inflow is closely regulated. A ratio of up to 1:20 is also possible with a special promeos Venturi-mix injector installed before the mixture-blower.

If special control systems equipped with electronic networks (for example mass flow sensors or valve regulators) are installed, then modulation ratios in excess of 1:20 are possible, and that at a constant gas-air ratio (Lambda λ, z.B. λ=1,3), i.e. during a regulated, complete combustion.

Exhaust gas values:

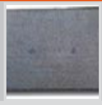
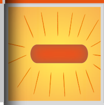
While conventional burners only produce minimal levels of emissions under certain operating conditions, the porous burner provides virtually constant low emission values over its whole operating range. This is a result of the total premix as well as, among other things, the extremely quick volumetric combustion.

NO_x: Even at very high power densities, i.e. at a very high burner performance, the NO_x-emission is minimal, which is not possible with open flames. Two features significantly reduce the NO_x-production.

1. The reaction time during the perfusion of the fine porous structure is too low for the production of NO_x.
2. The temperature in the reactor is lower than in the centre of an open flame as a result of the heat-radiating of the ceramic, which counteracts the production of NO_x.

CO: A highly turbulent reaction takes place in the porous structure. The air/gas mixture which has been previously mixed must pass through the burning porous structure at a constant, high temperature. There are no cool areas with incomplete combustion as in the outer area of an open flame.

Emissions (regarding 0% O_2 in dry exhaust gas)		
at 500 kW/m² and λ = 1,3	NO_x < 25 $mg/m^3_{exhaust\ gas}$	CO < 25 $mg/m^3_{exhaust\ gas}$
at 2.500 kW/m² and λ = 1,3	NO_x < 25 $mg/m^3_{exhaust\ gas}$	CO < 8 $mg/m^3_{exhaust\ gas}$

	Surface burners					promeos Volumeburner	
							
Combustion type	Open Flame	Catalytic-flame carpet	Flame carpet			Reaction without flame	Electric glowlamp
Shaping	1 Opening	Katalysator	Ceramic	Knitted metal foam	Sintered metal fiber	Ceramic foam	Glass pipes
Radiation Area	Minimal	Long wave	Medium wave	Medium wave	Medium wave	Short wave	NIR-Near-IR
Wave length µm	0,4	3,3 – 5	2,4	2,2	2,2	1,7	0,8 – 1,5
Max. radiation temp. °C	1.600 = Combustion-temperature	600	950	1.050	1.050	1.400	3.500
Max. surface performance kW/m²	1.000 – 30.000	30	120	200	250	1.000 – with emitters, otherwise max. 3000	2.500
Modulation	1:10 – 1:2	1:5	1:5	1:5	1:5	1:20	1:100
Examples of application	Heating systems, oil-fired burners, furnaces, industrial furnaces and driers	Space heating, Gas fired burners, Overhead heating, Drying processes, Heating systems for simple applications				Foundaries for aluminium and steel, glass, ceramic, paper, textiles, films and artificial materials	Thin transparent layers, laquering, prints, paper, films
Disadvantages	High level of emissions, low modulation	High levels of emissions, Weak modulation, Low power density, Low temperature levels				Worldwide service network is still under construction	High operating costs through electricity, no convection heat

Pictures of Surface burners: GoGas

COMPARISON OF TECHNOLOGIES

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