



Thermal spraying

Process engineering and
selection of gases



The right gas for the right process

Because of the variety of different thermal spraying processes, almost the entire range of technical gases is used. Most of the applications are for fuel gases and oxygen.

Fuel gases

Various hydrocarbons, especially acetylene, and also hydrogen are used. In addition to the fuel characteristics, aspects of the gas supply system are also important. Flame spraying guns can often be used for different fuel gases by changing the nozzles. For fusing, high performance fuel gases such as acetylene and Grieson® are generally preferred.

Conveying gases

Most guns work with an attached powder container and oxygen as internal conveying gas. In order to provide greater quantities of powder, external powder conveyors are used, normally driven by compressed air which has to be purified by means of oil and water separators. If inertization is required, argon, sometimes with added nitrogen, is used.

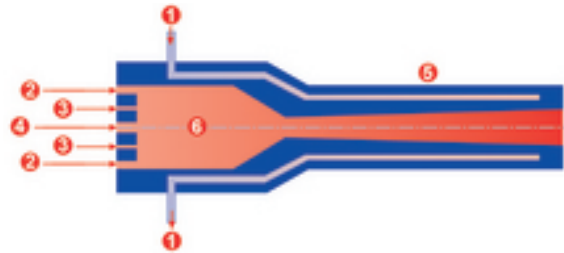
Gas supply

Flame spray guns have a fuel gas requirement up to several kilograms per hour. An acetylene supply system must be of adequate size and capacity. For high-speed flame spraying, the gases most used are propane, propene and hydrogen. Grieson® is also highly suitable. Typical pressures are between 5 and 7 bars, with a tendency going in the direction of 10 bars. Generally, acetylene can also be used (1.5/2.5 bars).

Gases for Thermal Spraying

Process/ Application	Gases
Flame spraying	acetylene, Grieson®, propane, hydrogen, oxygen
High velocity flame spraying	Grieson®, Mapp®, propane, hydrogen, oxygen acetylene
Plasma spraying	argon, helium, hydrogen, nitrogen, mixtures
Coolant	nitrogen, carbon dioxide
Fusing	acetylene, Grieson®, oxygen

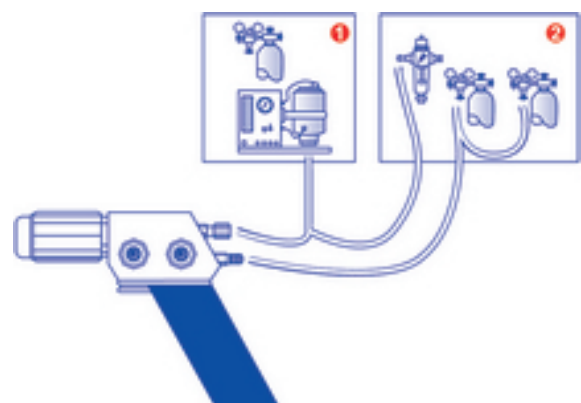
HVOF*-Torch



- 1) Cooling water
- 2) Cooling gas
- 3) Fuel gas/O₂
- 4) Powder
- 5) Expansion tube
- 6) Combustion chamber

* HVOF= High Velocity Oxy Fuel

Powder conveyor



- 1) Powder conveyor
- 2) Pressure control unit

Conveyor gases:
- nitrogen
- argon
- compressed air

Process technology and application

Flame Spraying with Powder or Wire

Flame spraying usually requires only low cost equipment. It is suitable for single piece and series production and can be used in both stationary and mobile configurations. Main applications are corrosion and wear protection. The use of wire or powder depends on the material and the application rate. Zinc, aluminum and molybdenum are mostly sprayed as wire. Most metal and hard-alloys are applied as powder.

Materials: Metals – Ceramics – Hard solids

Zinc and aluminum cover the range of active corrosion protection. For exposure to aggressive chemicals, CrNi alloys are used. For protection against mechanical wear, molybdenum, metal carbides and ceramics are mainly used. Ceramic materials such as Al_2O_3 and TiO_2 are often used for mechanical seals on chemical plants. These can only be produced as powders. To protect against impact damage, NiCrBSi coatings are sprayed and then fused. After fusing, these coatings possess a very high density and good resistance to wear.

High Velocity Flame Spraying

Where there are extra demands for sealing, adhesion and wear resistance of the coatings – for example in engine construction – high velocity flame spraying is often used. In this process, continuous combustion takes place inside a water-cooled combustion chamber. The expansion of the combustion gases in the expansion tube creates a supersonic flow, leading to very high acceleration of the spray material. The result is high coating density and strong adhesion to the base material. The most important application is wear protection using hard solid alloys with metal carbides (Tungsten- or Chromiumcarbides).

Component Preparation and Subsequent Treatment

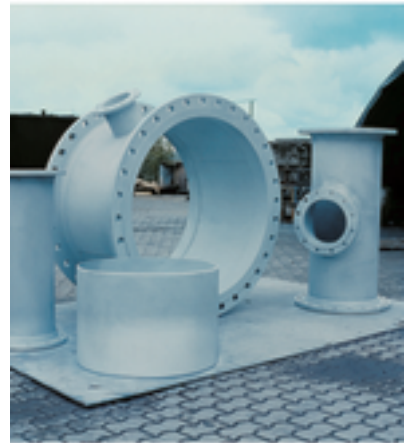
Preparation of the component includes degreasing and further blasting with sharp-edged corundum. Usually separate cabins with turntable devices are used for blasting and spraying. A typical subsequent treatment is the fusing of self-fluxing alloys. The fusing is carried out with a fuel gas/oxygen flame. Cold sprayed coatings are often sealed with epoxy resins to avoid corrosive influence.

Plasma Spraying

In plasma spraying, as in high velocity flame spraying, a supersonic flow is created. In this case the energy is generated electrically. The main area of application for plasma spraying is the manufacture of ceramic coatings such as oxides of chromium, aluminum and titanium. The deposition rate is very high. Plasma spraying can be carried out in a vacuum or under atmospheric conditions as well as in shielding gas atmosphere. It is mainly carried out with stationary systems.

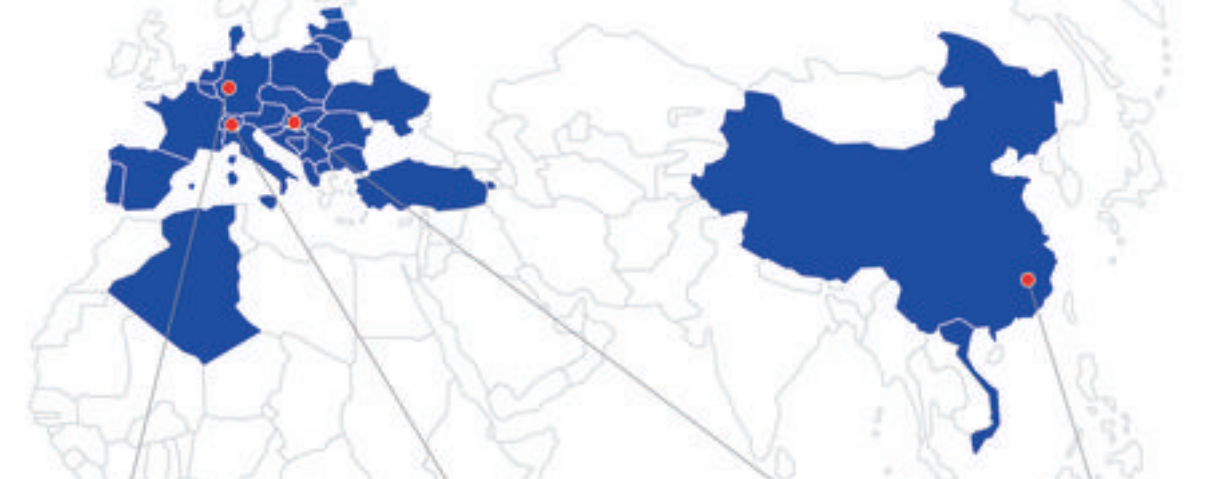
Noise Protection, Extraction

Emissions of smoke, noise and, in some cases, IR and UV radiation require protective measures. Of fundamental importance is extraction of the fumes as well as ear protection for the user. Spraying cabins with noise protection and smoke and particle extraction are often used, with the filter mounted in the open air. When spraying on construction sites, on large parts or in inaccessible positions, personal protection equipment is required.



Advice, Delivery, Service

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Technical centres – sources for innovation

For the development of new technologies in the field of welding and cutting, Messer operates technical centres in Germany, Switzerland, Hungary and China. These facilities provide ideal conditions for innovative projects as well as customer presentations and training courses.

Portfolio of gases – comprehensive and clear

Messer offers a spectrum of gases that extends well beyond the standard fare: it ranges from just the right gas for each application, and clear, application-oriented product designations to the continuous introduction of new gas mixtures designed to address current trends.

Specialised on-site consulting – right where you need it

Specifically in the context of your particular application, we can show you how to optimise the efficiency and quality of your processes. Along with process development, we support you with troubleshooting and process development.

Cost analyses – fast and efficient

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Training courses – always up to date

For the optimal handling of our gases, we can train you on processes and how to use them. Our training courses illustrate the use of various shielding gases for welding and explain how to handle them safely. This also includes the storage of the gases and the safe transport of small quantities. Information and training materials for your plant are also part of the service, of course.

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