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

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**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 Al₂O₃ and TiO₂ 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 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. In order to reduce the porosity for corrosion protection, cold sprayed coatings are often sealed with epoxy resins.

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 aluminum and titanium oxide. The deposition rate here is very high. Plasma spraying can be carried out in a vacuum or under atmospheric pressure, for example in an argon chamber. It is mainly carried out with stationary systems.

Noise Protection, Extraction
Emissions of smoke, noise and, in some cases, radiation require protective measures. Of fundamental importance is extraction of the fumes and ear protection for the user. Spraying cabins with noise protection and extraction are often used, with the filter mounted in the open air. When spraying on construction sites, on large parts or in inaccessible positions, the work is done wearing personal protection equipment.
Advice, Delivery, Service

MESSER offers a comprehensive program of gases, which is not always a matter of course. But that is far from all.

We can give advice on the choice of process or on questions of automation, we can tell you which type of supply – cylinder, bundle or cryogenic liquid supply – is the right one for you. We would also be glad to talk to you about the cost-saving potentials which may exist for your company in welding, cutting and related processes.

Information and training material for your company is naturally all included in the way of technical films which you can borrow free of charge, technical articles, brochures and special info on the many everyday questions relating to details of welding and cutting technology.

We will be happy to provide you with any information you may require, please contact:
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