

Nozzle is widely used in daily life, industrial production, agricultural production and military equipment. It is a very important component in spraying, spraying, fuel injection, sand blasting, spraying and other equipment, and plays an important role.

The material of the nozzle is from stainless steel and plastic to silicon carbide, polytetrafluoroethylene, PP (engineering plastic), aluminum alloy and tungsten steel, ceramics, etc. The application range is generally used in automobile, electroplating, surface treatment, high pressure cleaning, dust removal, cooling, Desulfurization, humidification, mixing, gardening, etc.



There are many classification criteria for nozzles, and nozzle classification can be categorized by nozzle function, material, industry, and shape.

(1) According to the nozzle function, it can be roughly divided into: spray nozzle, fuel injection nozzle, sand blasting nozzle, and special nozzle;

(2) According to the material classification, it can be divided into: metal nozzle, plastic nozzle, alloy nozzle, ceramic nozzle;

(3) According to industry classification, it can be divided into: petrochemical nozzle, agricultural nozzle, textile nozzle, paper nozzle, printing nozzle, environmental protection (desulfurization, denitrification, denitrification, dust removal, etc.) nozzle, spray nozzle, steel metallurgy nozzle, electronic nozzle, Food nozzle

(4) According to the shape classification, it can be divided into hollow cone nozzle, solid cone nozzle, square nozzle, rectangular nozzle, elliptical nozzle, fan nozzle, column flow (direct current) nozzle, two-fluid nozzle, multi-fluid nozzle and so on.

The factors that select the nozzle are flow, pressure, spray angle, coverage, impact force, temperature, material, application, etc., and these factors are often intertwined and mutually constrained. The performance of the nozzle is

related to the material, process and technology of the nozzle. However, in some special environments that require high temperature and corrosion resistance, the material performance requirements of the nozzle are extremely high.

Various material nozzles mainly include: metal nozzles, plastic nozzles, alloy nozzles, ceramic nozzles, etc.

(1) Metal nozzles play an important role in the field of industrial nozzles and are widely used in industry. Metal nozzles have a large share of the nozzle market. Domestic manufacturers of nozzles are increasing, but domestic technology is far from foreign technology, and most of them still use imported nozzles. Metal nozzles are very difficult to produce due to their hardness. Domestically, we still need a lot of talents in mechanical research and development.

(2) Plastics are important organic synthetic polymer materials and are widely used. The plastic nozzle is light in weight, chemically stable, does not rust; has good impact resistance; has good transparency and wear resistance; has good insulation and low thermal conductivity; generally has good formability, coloring property and low processing cost; However, the plastic nozzle has poor heat resistance, large thermal expansion rate, easy combustion, poor dimensional stability, easy deformation, poor low temperature resistance, brittleness at low temperature, and easy aging; some plastic nozzles are easily soluble in solvents.

(3) Alloy is a material having metal characteristics synthesized by a certain method from two or more metals and metals or nonmetals. Generally obtained by melting a homogeneous liquid and solidifying. According to the number of constituent elements, it can be divided into binary alloys, ternary alloys and multicomponent alloys. Advantages of cemented carbide nozzles: Corrosion resistance, long service life, excellent performance, high cost performance, and high wear resistance.

Ceramic nozzles have been continuously improved since they were introduced to China in the 1990s. Mainly improved from the shape and material:

(1) Shape: The shape of the ceramic nozzle from the earliest spiral type, large volume, two sprays, gradually developed into spiral type, eddy current type, small volume.

(2) Materials: Materials have also evolved from oxide ceramics to nitride ceramics and carbide ceramics.

Ceramic nozzles mainly include the following material nozzles:

(a) Oxide ceramic nozzles (referred to as alumina and zirconia materials) (Fig. 3). Oxide ceramic nozzles have been phased out due to their inferior performance to nitride ceramic nozzles and carbide ceramic nozzles. The market mainstream products are nitride ceramic nozzles and carbide ceramic

nozzles.

(b) nitride ceramic nozzle

Nitride ceramic nozzle (refers to silicon nitride combined with silicon carbide material) has the advantages of high hardness, strong wear resistance, and advantages and disadvantages. The material can not be used as a spiral nozzle.

(c) Carbide ceramic nozzle

Carbide ceramic nozzle (refers to silicon carbide, boron carbide material), carbide ceramic has high temperature resistance, oxidation resistance, high strength, extreme cold and extreme heat resistance, good thermal shock resistance, so the advantages of carbide nozzle is high hardness. If the ductility is good, it can be used as a spiral nozzle or as a vortex nozzle.

Among them, silicon carbide (SiC) ceramic nozzles can be used in desulfurization of power plants to remove sulfur dioxide and some polluting gases from power plant flue gas. The flue gas of coal-fired power plants and the combined combustion of coal-fired gas for gas turbines have a common task. Desulfurization and denitrification (and of course dust removal). The flue gas discharged from the power plant without desulfurization and denitrification directly pollutes the atmospheric environment, and the combined cycle gas will harm the hot end parts of the gas turbine without purification. Its exhaust will also pollute the environment.

Ceramic nozzles are key components of thermal power plants, large boilers, and desulfurization and dust removal equipment. The domestically produced reaction-sintered silicon carbide desulfurization and dust removal nozzle gradually replaces imported products, and has excellent properties such as high strength, high hardness, strong corrosion resistance, severe wear and high temperature resistance, and has an extremely long service life under severe conditions. Silicon carbide spiral nozzles are one of the most distinctive of the many nozzles. As the spiral becomes continuously smaller, the slurry is continuously tangentially and spirally tangentially deflected into a sheet-like jet into concentric axial cones, and the liquid is not obstructed in the passage from the nozzle chamber to the outlet. It also has a high absorption efficiency at very low operating pressures and is widely recognized as a desulfurization system.

Boron carbide (B₄C) ceramic nozzles (Fig. 4) can be used in the military gunpowder industry to make gun nozzles. Boron carbide is extremely hard and wear-resistant, does not react with acid and alkali, high temperature, low temperature, high pressure resistance, density $\geq 2.46\text{g/cm}^3$; microhardness $\geq 3500\text{kgf/mm}^2$, flexural strength $\geq 400\text{MPa}$, melting point is 2450°C . The boron carbide nozzle has the above-mentioned high wear resistance and high hardness, and it will gradually replace the known sandblasting nozzles of cemented carbide, tungsten steel, alumina, zirconia, silicon nitride, silicon carbide and the like.

Boron carbide ceramic nozzles can also be used for water cutting technology.

Water cutting technology is now widely used in all walks of life. Waterjet uses this technology to make water as sharp as a knife. How to control water jet The nozzle is perfectly cut within the cuttable range, at which point the nozzle plays a decisive role. The high pressure water jet device is centered on the nozzle because the nozzle is a direct device for forming a water jet, and the effect it can directly affect other parts of the system. It is not possible to ignore small accessories because of the focus on the main equipment, and often small accessories can play a vital role. The nozzle is an important component of the water jet device, which not only controls the cutting speed of the water jet but also restricts the other components of the system.



Hot pressed Boron carbide nozzle for sandblasting

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