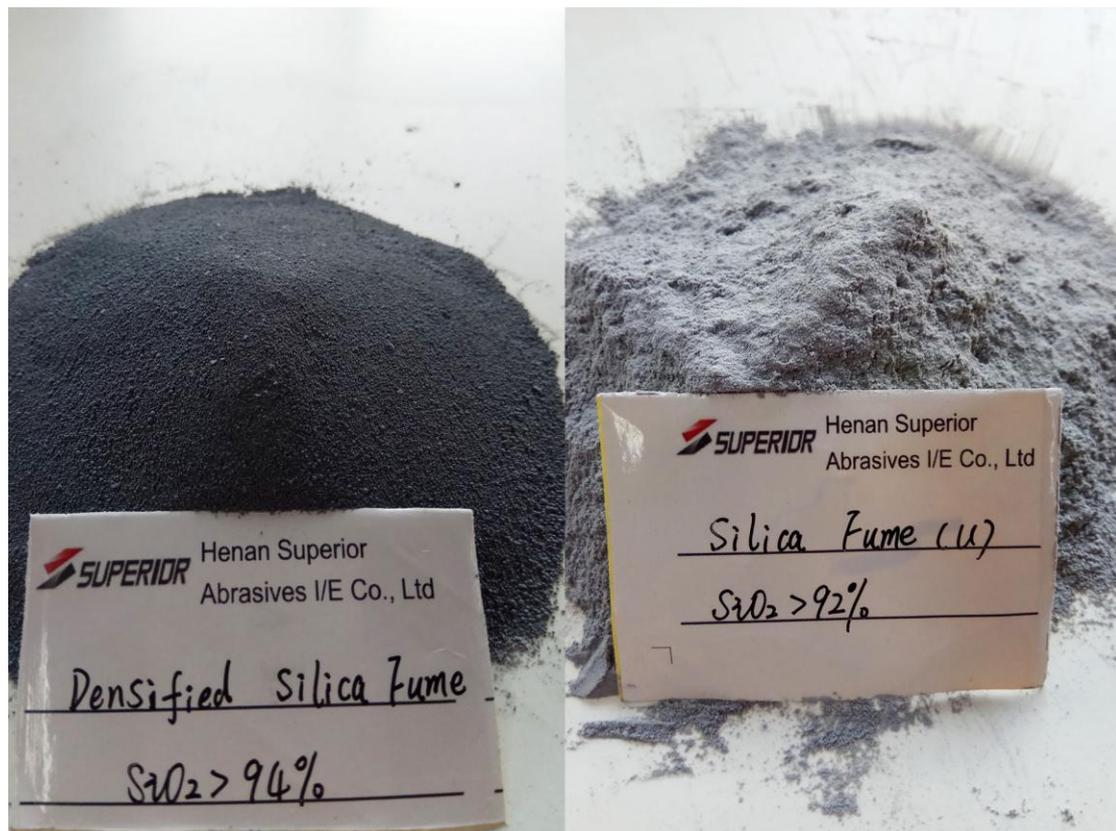


Advantages and Disadvantages of Silica Fume in Concrete



Silica fume is a byproduct of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Because of its chemical and physical properties, it is a very reactive pozzolan.

Silica fume consists primarily of amorphous (non-crystalline) silicon dioxide (SiO_2). The individual particles are extremely small, approximately 1/100th the size of an average cement particle. Because of its fine particles, large surface area, and the high SiO_2 content, silica fume is a very reactive pozzolan when used in concrete. The quality of silica fume is specified by ASTM C 1240 and AASHTO M 307.

Silica Fume has been used all over the world for many years in the area where high strength and durable concrete were required. Silica Fume improves the characteristics of both fresh and hard concrete. Concrete containing silica fume can have very high strength and can be very durable. Silica fume is available from suppliers of concrete admixtures and, when specified, is simply added during concrete production. Placing, finishing, and curing silica-fume concrete require special attention on the part of the concrete contractor.

Advantages of silica fume in concrete:



- (1) silica fume is a kind of neutral inorganic filler with very stable physical and chemical properties. It does not contain crystalline water, does not participate in the curing reaction, and does not affect the reaction mechanism.
- (2) good infiltration for various kinds of resin, good adsorption performance, easy to mix, no agglomeration phenomenon.
- (3) the size distribution of silica fume is reasonable, strong densification, large hardness and wear resistance. It can greatly improve the tensile strength, compressive strength, impact strength and wear resistance of the cured products, and the abrasion resistance can be increased 0.5 – 2.5 times.
- (4) it can increase the thermal conductivity, change the adhesive viscosity and increase the flame retardancy.
- (5) the exothermic peak temperature of curing reaction of epoxy resin can be reduced, the linear expansion coefficient of solidified products and the shrinkage rate of solidified products can be reduced, so as to eliminate internal stress and prevent cracking.
- (6) due to the fine grain size and reasonable distribution of silica fume, it can effectively reduce and eliminate precipitation and stratification.
- (7) pure silicon powder, low content of impurities, stable physical and chemical properties, so that the curing material has good insulation properties and arc resistance.
- (8) the chemical composition of silica fume is silica (SiO_2), which belongs to inert material. It doesn't react with most acids or alkaloids. The silicon powder is evenly distributed and covered on the surface of objects. It has strong corrosion resistance and cavitation resistance increased 3-16 times.
- (9) small bulk density, 0.2 – 0.8, or 1 – 2.2. As polymer filling material, it can reduce the cost of the product by reducing the amount of loading and saving the amount of polymer.
- (10) frost resistance is good, and the relative elastic modulus of micro silica fume is 10 to 20% after 300-500 fast freeze-thaw cycles, while the average elastic modulus of ordinary concrete is 30 to 73% after 25-50 cycles. Therefore, the frost resistance of concrete can be improved.
- (11) early strength, microsilica concrete can shorten the induction period and have the characteristics of early strength.

Disadvantages of silica fume in concrete:

1. dry shrinkage.

Silica fume concrete shrinkage rate is large, especially early dry shrinkage, easy to make crack in the application of silica fume concrete, affect the overall strength and using effect. For example, after construction, strengthening water and sprinkler maintenance can decrease this problem, but the cracks are still unavoidable in many construction projects.

2, the construction is difficult.

The workability of concrete is an important parameter in the design of concrete mix proportion, silica fume concrete workability is poor, is not easy to make the concrete vibrating close grained, not easy to plaster, influencing the smoothness of concrete quality and uniformity of the surface.

3, it is easy to produce temperature cracks.

Concrete with silica fume early strength develop quickly, the corresponding concrete hydration heat dissipation quickly, resulting to rise concrete hydration heat temperature, easy to produce high temperature stress in the concrete, the stress concentration in the top of the dry shrinkage crack, make dry shrinkage crack extend even through the formation of transfixion cracks.

Silica fume used in Concrete: <http://www.microsilica-fume.com/silica-fume-concrete.html>

If you want to know more about microsilica / silica fume in concrete technology, please contact us by E-mail gaom@superior-abrasives.com, thank you.