

## The Research on the Additives of the High Performance Concrete

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### ABSTRACT

With the development of technologies of admixture and additive in concrete, the technological base for making up high performance concrete has been laid. High performance concrete should have not only high strength, but also excellent durability, relatively high temperature crack resistance and relatively high volume stability, etc. The most effective ingredients for making up high performance concrete are super-plasticizing agent, fly ash or slag powder, silicon powder. Main properties and usages of these materials are briefly expounded to provide some practical guides for making up high performance concrete.

**Key words**-high performance concrete, additive, admixture, material property

### I. INTRODUCTION

For a long time, the main basis of measuring the concrete performance has been to the compressive strength. But many concrete structures, especially the structures in the harsh environment, due to its poor durability have been or are being subjected to severe damage. Therefore, the durability of the concrete structure currently have been paid more and more attention. Except the strength and durability other properties of the concrete is also subjected to more attention, on the one hand, engineering requires the concrete has high strength; on the other hand, and the water thermal shrinkage and creep should be as low as possible. Also should have a higher fluidity, high early strength, high elastic modulus and high tensile strength and so on. The characteristics of making up high performance concrete is the low water binder ratio, adding a sufficient number of fine mineral admixture and high efficient additives.

### II. SUPERP-LASTICIZER

Super plasticizer mainly has two types, namely, naphthalene sulfonate formaldehyde condensate and melamine sulphonated condensates. The mechanism of super plasticizer is similar to the ordinary plasticizer. The mechanism is mainly to reduce the inner frictional resistance between cement particles, so as to improve the fluidity of the cement paste. Therefore, super plasticizer can significantly reduce the water cement ratio of the concrete, so as to improve the concrete physical, mechanical properties and durability.

### III. FLY ASH

Fly ash is industrial waste which produced by coal-fired power plants and reclaimed by some way, it contains silicon dioxide which can react with calcium hydroxide produced by the hydration of cement, the reaction produces hydrated calcium silicate, and the process is known as pozzolanic

reaction. Therefore, the add of fly ash will improve the strength of the concrete, if the strength grade of the concrete remains, the amount of cement will reduce. In fact, fly ash often used as replacement of cement, which will not only lead to reduce the cost of concrete, and also reduce the early hydration heat of the concrete. For the large volume high performance concrete the add of fly ash can reduce the early hydration heat, thus avoid the early cracking of concrete. Because of fly ash particle shape effect, fly ash usually can improve the fluidity of concrete. But fly ash can also slow down the strength development of the concrete, so fly ash concrete has relatively low early strength and relatively high intensity of the latter.

### IV. SILICON POWDER

Silicon powder is a by-product of smelting metal silicon and ferrosilicon production. The main ingredient is silicon dioxide (0.1 ~ 0.2 m), just as the fly ash silicon powder also can react with the calcium hydroxide produced by the hydration of cement and produce hydrated calcium silicate. Because of the high content of silicon dioxide in silicon powder (silicon dioxide content as high as 85% and above) and the very fine particles, so it has very high pozzolanic activity. In addition, when it distributed evenly in the water of the product, its very fine particles also has good micro filling effect. The above two features resulted in a significant improvement in the strength and durability of concrete. Due to ultra-high fineness powder the silicon powder in concrete with very high water demand, study found that, after the concrete mixed with 1 kg of silicon powder, in order to maintain the flow of constant generally require increased 1kg water. Therefore, the silicon powder, only when be used with super plasticizer its potential can be full played.

When the content is low, the contribution of silicon powder on concrete strength equivalent

to at least 2 to 3 times the amount of cement. However, the effect will decrease with the volume increase. When the content is more than 20% of total cementitious material, the enhancement effect will be very small. Therefore, the amount of silicon powder is rarely higher than 20%. In fact, when the silicon powder content is too high, the fresh concrete will become very thick and increase the construction difficulty. On the other hand, the price of silicon powder is much higher than that of cement powder. Thus under the strength and other performance requirements condition the content generally ranges from 5% to 15%.)

## V. CONCLUSION

Some cases such as large volume of hydraulic structure and foundation engineering do not require high strength (C25~C30 around), but require high durability, work uniformity and volume stability. Academician Wu Zhongwei believes that high performance concrete should be according to the requirements of the project to determine minimum strength index, without damage the internal structure the properties and development of the concrete, in order to ensure the durability and volume stability of important performance.

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