

CfFA® High-quality Fly Ash as an Admixture for Concrete

1. Challenges with fly ash as admixture for concrete

Fly ash (“FA”) offers advantages in improvement of concrete performance, such as improved workability, prevention of temperature cracks, greater durability, increased long-term strength, and inhibition of alkali-silica reaction. Its quality as an admixture has been established as a JIS standard (see Table 1).

To increase the use of FA in concrete, however, the problem of variation of quality depending on the type of coal as its material and the combustion conditions that optimize combustion efficiency apparently needs to be overcome since unburned carbon remaining in FA influences the amount of air contained in the concrete or the properties of the ready-mixed concrete. Unburned carbon in FA is porous (see Figure 1) and absorbs the agent for entraining air that inhibits solidifying of concrete (air entraining agent). Therefore, when using FA the amount of air entraining agent to be blended needs to be adjusted in ways such as considering the amount of unburned carbon (“loss on ignition”). However, the amount differs from lot to lot, which complicates the work.

2. Technological edge of ZEROTECHNO

(<http://www.zerotechno.net/english/high-quality-fly-ash-cff>)
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The CfFA® developed by ZEROTECHNO is high-quality fly ash. It is classified as JIS type-II fly

ash because of a technology that burns it to reduce loss on ignition in FA to 1.0% or less; a level at which it is not affected by absorption of the agent. Specifically, FA is heated in an indirectly heated rotary kiln to a temperature of 800-900°C to eliminate unburned carbon by spontaneously burning it. Key technological points for this process are to control the burning temperature at an appropriate level and burn the FA evenly.

CfFA® is expected to grow increasingly popular in the future due to factors such as how it solves the quality problem of FA and facilitates establishment of a supply system when its uniform quality is achieved. About 10-20% of cement is assumed to be replaced with CfFA® in standard concrete composition (see Figure 2).

Table 1. JIS standard for fly ash as an admixture for concrete

		JIS A 6201 standard			
		Type I	Type II	Type III	Type IV
Silicon dioxide (%)		45.0 or more			
Hygroscopic moisture (%)		1.0 or less			
Loss on ignition (%)		3.0 or less	5.0 or less	8.0 or less	5.0 or less
Density (g/cm ³)		1.95 or more			
Fineness	Residue on 45 μm sieve (%)	10 or less	40 or less	70 or less	
	Blaine's specific surface area (cm ² /g)	5,000 or more	2,500 or more	1,500 or more	
Flow value ratio (%)		105 or more	95 or more	85 or more	75 or more
Activity index (%)	Material age: 28 days	90 or more	80 or more	60 or more	
	Material age: 90 days	100 or more	90 or more	70 or more	

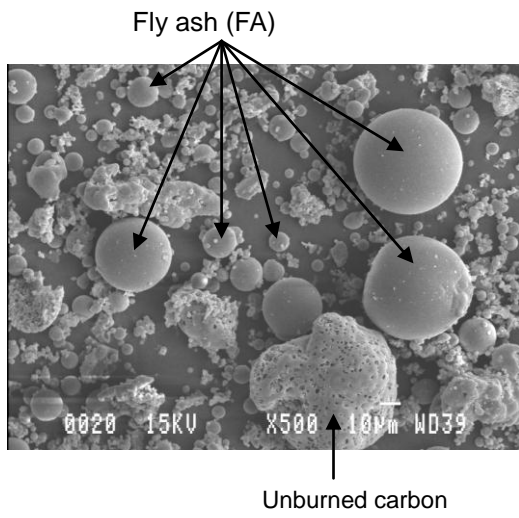


Figure 1. Electron microscopic picture of fly ash

