

STUDY ON SURFACE DEGRADATION OF LCFA-GGBF GEOPOLYMERS BY PARTIAL WATER ABSORPTION AND SILANE IMPREGNATION TECHNIQUES

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When the pore solution becomes supersaturated in Portland cement hardened bodies due to evaporation of moisture, temperature change and so on, salts dissolved in the pore solution precipitate and the surface whitening (efflorescence) and surface roughening may occur. Similar phenomena also occur in hardened geopolymer (GP) (Fig.1). Formation process and resultant minerals are different from those of Portland cement and there are a few studies on GP so far on these events. In this paper, efflorescence and surface roughening were studied using low calcium coal fly ash (LCFA) / ground granulated blast furnace-slag (GGBS) type GP. Primarily, these phenomena were studied by partial water immersion technique (Fig.2). Subsequently, surface impregnation technique by a silane was performed and effective results were obtained as follows:

- (1) Since efflorescence and surface roughening were promoted in the refrigerator rather than in the constant temperature room (20°C, 60%RH), deterioration of the surface layer of GP is more likely to proceed as the temperature and humidity are lower. In addition, repetition of temperature change promotes deterioration of the surface layer.
- (2) Efflorescence and surface roughening of GP impairs not only aesthetic appearance of the structure but also sometimes lowers proof stress, so certain measures are necessary.
- (3) Efflorescence and surface roughening of GP can be suppressed by increasing the GGBS substitution rate (Fig.3).
- (4) Adjustment of the concentration of alkaline solution may suppress efflorescence and surface roughening.
- (5) The silane-based surface impregnating material for OPC concrete has the effect of reducing the rate of efflorescence and surface roughening of GP.



Figure 1 – Degraded GP walkway boundary block placed on strongly acidic soil (Beppu Myoban Spa, Oita, Japan)

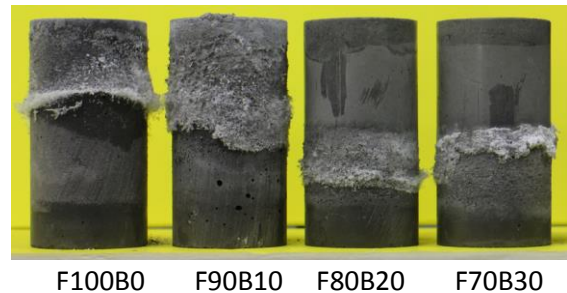


Figure 3 – Comparison of appearance by GGBS substitution rate (After 8 week storage in refrigerator)

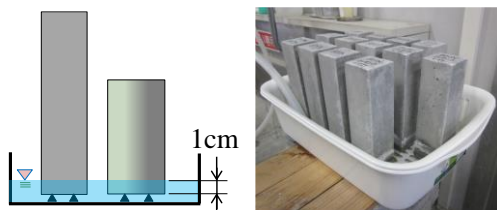


Figure 2 – Partial water absorption test