

พิมพ์ต้นฉบับบทความวิทยานิพนธ์ภายในกรอบสี่เหลี่ยมนี้เพียงแผ่นเดียว

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KEY WORD: SILICA FUME / HYDRATION REACTION / POZZOLANIC REACTION / THERMOGRAVIMETRY ANALYSIS
SOMPOP SUWANKAWIN : EFFECTS OF SILICA FUME IN POZZOLANIC REACTION ON
COMPRESSIVE STRENGTH OF HIGH PERFORMANCE CONCRETE. THESIS ADVISOR :
PROFESSOR EKASIT LIMSUWAN, Ph.D. 109 pp. ISBN 974-635-869-3

Significant chemical reactions in cement paste with silica fume consist of hydration reaction of cement and pozzolanic reaction of silica fume. The products of hydration reaction are calcium silicate hydrate and calcium hydroxide while pozzolanic reaction consumes calcium hydroxide to produce calcium silicate hydrate, which is related to the compressive strength of concrete. To determine amount of calcium hydroxide in this study, Thermogravimetry Analysis (TGA) are required, and then the amount of calcium silicate hydrated can be calculated from the molecular weight on the basis of chemical composition. The principal concept of the Thermogravimetry Analysis for calcium hydroxide which is decomposed at $450 - 600 \text{ }^{\circ}\text{C}$ so that weight loss can be obtained. The study has considered silica fume as substitution of cement between 5 - 25 % by weight and the concrete mixes are 500 kg./m^3 of cement and the water to fine ratio $[w/(c+sf)]$ of 0.26 - 0.32. Essential high performance concrete properties in fresh and harden states must be maintained and adjusted by means of chemical admixture dosage.

The amount of calcium hydroxide content in cement paste is tested to be increased by age of hydration reaction while the silica fume substitution has shown reduction rate of increment after the age of more than 7 days due to consumption of calcium hydroxide in pozzolanic reaction. The reaction has shown some indication by means of calcium hydroxide consumption since the first day of mixing. However, at early age, the calcium silicate hydrate has shown slightly significant with lower content of silica fume (5 - 10 %) but it will be influenced by amount of silica fume more than 15 %. At the age more than 7 days, the amount of calcium silicate hydrate has significant developed even the amount of silica fume at 5 %. The compressive strength has indicated direct proportion to the amount of calcium silicate hydrate in linear proportion with coefficient of variance at 0.95 - 1.05. Strength development of concrete with 15 % silica fume has shown the most effective in early age and the strength at 1 , 3 and 28 days has been 55 , 90 , 140 % of the control ones at 28 days. On the other hand, the development of low content of silica fume at 5 % has shown 50 , 80 and 110 % at the age of 1 , 3 and 28 days, respectively, in comparison to the control ones. The most effective proportion to comply both strength and workability, the mixes of 5 % silica fume, water to fine ratio 0.32 and the cement content 500 kg/m^3 , are the most suitable ones. However, if the only high strength is considered, then the silica fume substitution at 15 % may be used with some adjustment of workability by means of chemical admixture dosage.

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