INFLUENCE OF CURING TEMPERATURE CHANGE ON PERFORMANCE OF FLY ASH AS CEMENTITIOUS MATERIAL

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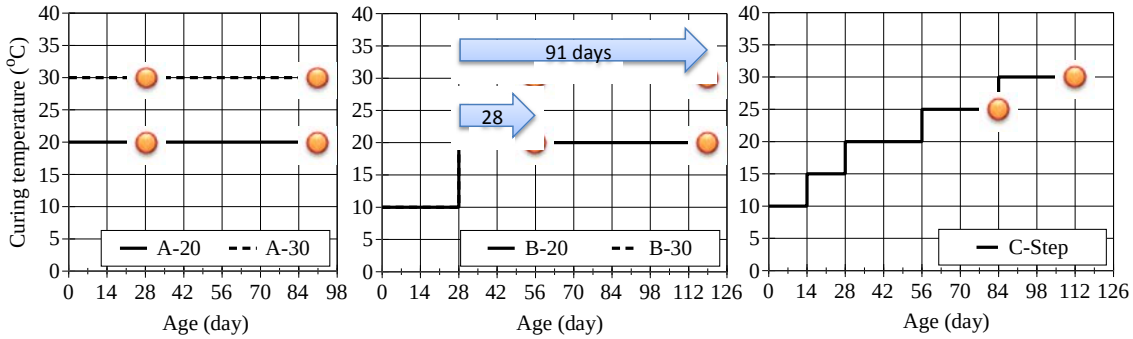
Global warming resulting from carbon dioxide emissions is one of the major problems facing the world. The development of sustainable societies depends on many countries reducing their carbon dioxide emissions. One important source of emissions is the manufacture of cement, but these can be reduced by using fly ash as an alternative binder to cement.

This study investigates the influence of curing temperature changes on the performance of fly ash as a binder. The fly ash fraction is fixed at 15% of binder mass. Four curing temperature variations are studied (see Fig. 1): 20°C or 30°C (condition A); 10°C early-age and then 20°C or 30°C (condition B); graduated curing temperature from 10°C to 30°C (condition C); and curing in water (condition D). The compressive strength of the mortar, k-value and amount of calcium hydroxide are measured under each condition. Strength and k-value with maturity are also measured (the temperature-time factor), using cumulative temperature as an index.

The strength of mortar can be predicted from cumulative temperature is the standard -10 °C, even if the mortar contains 15% of fly ash. On the other hand, k-value of fly ash cannot be predictied from cumulative temperature using -10 °C as the datum temperature.. However, if a datum temperature suitable for fly-ash reaction is chosen, such as 17°C as in this experiment, then k-value can be predicted (see Fig. 2)**.** The chosen datum temperature can be adjusted depending on the quality of the fly ash used.

The results show that, even though fly ash does not react effectively during low-temperature curing at an early age, it does react and contribute to mortar strength as a cementitious material in a higher temperature environment. This means that fly ash could be used more generally in cement if curing conditions and the fly ash fraction are appropriate.



(a) Condition A (b) Condition B (c) Condition C

Fig. 1 Curing conditions studied
(Circles represent times of strength measurement)

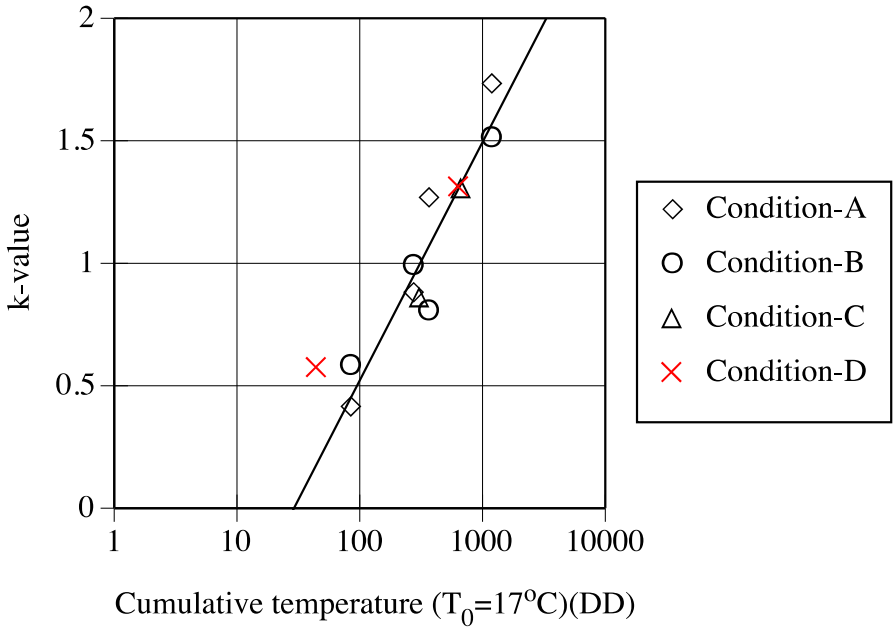


Fig. 2 Evaluation of k-value from cumulative temperature where the datum temperature is 17°C