Chloride penetration into silica fume concrete subject to different exposures

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Abstract:

The increasing trend in the use of silica fume blended cement in Eastern Saudi Arabia for the improvement of corrosion resistance of reinforced concrete has brought into focus a need for a better understanding of the transport mechanism of chloride ions in silica fume concrete in the prevailing environmental conditions. In the present work, chloride penetration into plain and silica fume cement concrete specimens was investigated under different exposure conditions to determine the apparent diffusion coefficients. For this purpose, data pertaining to chloride profiles were generated through an experimental program in which cylindrical and slab concrete specimens, cast with different water/cement ratios and quantity of silica fume, were exposed to 15% sodium chloride solution under four exposure conditions that included indoor and outdoor environments and heat-cool and wet-dry cycles. Using the experimental data, apparent chloride diffusion coefficients were calculated using Fick's second law of diffusion. Test data show that the apparent chloride diffusion coefficient for a given concrete depends on the type of cement in concrete and the exposure conditions. While the chloride diffusion coefficients in the silica fume cement concrete were less than that in the plain cement concrete, these values in the concrete specimens exposed to heat-cool cycles were found to be higher than those in the specimens exposed to other conditions investigated in this study.