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Discussion

A discussion of the paper "The use of tension testing to investigate the effect of W/C ratio and cement type on the resistance of concrete to sulfate attack" by Andrew J. Boyd, Sidney Mindess☆

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The paper provides an interesting study of the effect of sodium sulfate solution on semi-immersed concrete cylinders. The "tension testing" procedure is especially interesting. Unfortunately, the paper fails in many respects to either elucidate on distress mechanisms or study results.

First, the title specifies "sulfate attack" but some—even much—of the distress may be due to physical salt attack due to precipitation of sodium sulfate as either thenardite or mirabilite or both. The sodium sulfate solution can rise along the outside surface of the concrete (as indeed the authors report) and repeatedly precipitate out, depending on the laboratory temperature and relative humidity. It need not enter into the cylinder to do so except where it repeatedly precipitates.

Second, the authors use the term "sulfate attack" without definition. With sodium sulfate solution, two methods of attack involving the sulfate ion are possible: (1) reaction of the sulfate ion with aluminates to produce sulfoaluminates (monosulfate or ettringite), or (2) reaction with calcium hydroxide to produce gypsum. Unfortunately, the authors do not present the chemical analysis data for the cements so that this can be better evaluated. C_3A and SO_3 contents are necessary for the sulfoaluminate reaction evaluation (specifically, the SO_3/C_3A ratio, not the C_3A ratio alone), and the C_3S and C_2S contents for the gypsum formation evaluation.

Third, the authors fail to provide any explanation why the tests fail to show any loss from the initial measurement of the prisms in sodium sulfate solution to the final one, except for the 0.65 w/c, Type 50 cement.

Fourth, the authors failed to make any study of the tested cylinders to determine the actual mechanisms for distress. If they have the specimens, I volunteer to have them studied by optical petrography, and by SEM, if necessary.

Finally, and simply as a pet peeve, in their title, the "W/C ratio" is redundant.

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