



## Discussion

A discussion of the paper  
“Chemical changes in concrete due to the ingress of chemical species”  
by P.W. Brown and April Doerr<sup>☆</sup>

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Received 18 July 2000

The paper by Brown and Doerr is a disservice to the literature and puts into question the review process by the editors of *Cement and Concrete Research*.

First, Eqs. (1), (2), and (4) are unbalanced; further, Eq. (2) introduces a strange new compound,  $\text{HCO}_3$ .

Second, the authors use EDS spectra to imply significant formation of compounds due to influx of “aggressive species.” They ignore the facts that (a) the EDS analyses represent the elemental concentrations within a volume of less than one-trillionth of a cubic inch and (b) the elements may not indeed indicate the phenomena or the compounds they represent them as (e.g., “magnesium enrichment in Fig. 2a,” thaumasite in Fig. 3, and sodium carbonate in Fig. 5).

Third, in their second sentence, the authors state that “Sulphate attack of concrete foundations . . . was documented.” Indeed, no classic evidence of sulfate attack was found in virtually any of these homes. Rather than surface layers of gypsum or ettringite, what was found (at least by those not using techniques like thin sections that remove the evidence) was thenardite and mirabilite, proving that the

distress was due to “salt hydration distress,” as we term it: the destructive conversion of thenardite to mirabilite.

Fourth, the authors state that “... this formation of sodium sulfate on a structure is an indication of sulfate attack occurring in the interior of that concrete.” It is no such thing, but rather a result of that salt wicking up the concrete surface after having dissolved every morning from the soil when the sprinklers turn on. The “linear” appearance of this efflorescence (occurring about 2 in. above the soil) demonstrates this and can be duplicated in the laboratory.

Having investigated most of the homes Dr. Brown and his colleagues studied, it is our opinion that they have revolutionized “sulphate attack” literature by depending upon SEM analyses of vanishingly small areas and volumes, not discovering, as we have, that most of the same spectra can be found in concrete with California aggregate that has never been exposed to any “aggressive species”, and ignoring the lack of any optical petrographic evidence for sulphate attack.

<sup>☆</sup> Cem Concr Res 30 (3) (2000) 411–418.

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