

solutions into the concrete and to the precise hydration products formed, which are all influenced by the permeabilities of the hardened concrete structures. Thus this paper<sup>(1)</sup> is a useful contribution towards our greater appreciation of the numerous practicalities of attack upon Portland cement concrete in sulphate environments.

### **References**

1. S. Kumar and C.V.S. Kameswara Rao, *Cem. Concr. Res.* **24**(7), 1237 (1994).
2. D. Bonen and M.D. Cohen, *Cem. Concr. Res.* **22**(4), 707 (1992).
3. J. Bensted, *Cem. Concr. Res.* **23**(3), 743 (1993).
4. F.M. Lea, "The Chemistry of Cement and Concrete", Edward Arnold (Publishers) Ltd., London (1970).
5. T.D. Robson, "High Alumina Cements and Concrete", Contractors Record Ltd, London (1962).
6. H.G. Midgley, in "Calcium Aluminate Cements", (Ed. R.J. Mangabhai), p.1, E. & F.N. Spon, London (1990).
7. C.M. George, "The Structural Use of High Alumina Cement Concrete", Lafarge Fondu International, Neuilly-sur-Seine (1975).
8. J. Bensted, *Zem.-Kalk-Gips*, **46**(3), 580 (1993).
9. Y. Fu, P. Gu, P. Xie and J.J. Beaudoin, *Cem. Concr. Res.* **25**(1), 63 (1995).
10. C.D. Lawrence, *Cem. Concr. Res.* **25**(4), 903 (1995).
11. F.P. Glasser, D. Damidot and M. Atkins, *Adv. Cem. Res.* **7**, No. 26, 57 (1995).

**A Reply to the Discussion by J. Bensted and J. Munn of the Paper  
"EFFECT OF SULFATES ON THE SETTING TIME OF CEMENT AND  
STRENGTH OF CONCRETE"\***

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The authors are thankful to Bensted and Munn for their interest in the paper and their comments. The authors agree that the formation of non-bonding magnesium silicate hydrate  $M_2SH_x$  can also occur and influence the basic chemistry of the phenomenon. Further work in this area will add to our understanding of the influence of sulfate environments on the behaviour of portland cement concretes.

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\*CCR 24(7) 1237-1244 (1994)