

THE MINERALOGY OF SULFATE AND SEA WATER ATTACK ON CONCRETE INTERPRETED FROM EPMA ANALYSIS

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ABSTRACT

A three year project investigating the mineralogical processes of sulfate and sea water attack of concrete is described. The aim of the project is to experimentally test a model which predicts that the mineralogy of concrete altered by chemical attack is governed by the existence of stable or metastable equilibrium within localized zones, even though a state of equilibrium does not exist across the entire system. The model is tested experimentally in the laboratory, and by detailed examination of concretes of wide ranging composition exposed to sea water for 18 years at an exposure site on the west coast of Denmark. Electron Probe Microanalysis (EPMA) results are presented in this paper which, although not providing independent confirmation of the above model, indicate the AFm phases to consist of monosulfate intimately mixed with the C-S-H phase, and a solid solution of Friedel's salt and monocarbonate. Ettringite, although regarded as part of the same phase assemblage, is found almost exclusively in original air voids. Ingress of chlorides to a depth of 100 mm from the concrete surface is markedly reduced in concrete containing fly ash. This seems at least in part to be the result of the greater binding capacity of the AFm solid solution phase.