

CHANGE OF PORE STRUCTURE IN SLAG-CEMENT PASTE

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Slag is one of the major SCM used in the cement industry. Blended with cement, slag offers many benefits due to its own reaction in addition to cement hydration. As a result the formation of hydrates [1] and thus the microstructure development are changed compared to pure cement paste [2]. The low permeability of the microstructure in slag-cement paste is regarded as the major reason of its better long-term durability. However it is still not clearly understood how this refinement is achieved. Consequently it is difficult to predict the long term properties of the slag-cement concrete.

This study reports on the development of the microstructure in slag-cement system. Ternary systems consisting of cement blended with quartz and slag were studied. To isolate the effect of slag increase, the replacement level of cement was kept constant and the proportion of slag and quartz were tuned. The microstructure of slag-quartz cement pastes were analyzed by SEM-EDS and Mercury Intrusion Porosity. The reaction of slag was recorded with isothermal calorimeter for 28 days.

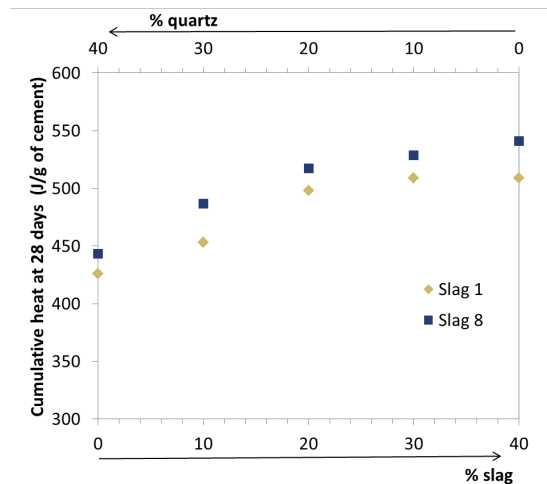


Fig. 1: Cumulative heat at 28 days as a function of slag content in cement-slag-quartz systems. The cumulative heat reaches a plateau for system with 20%slag-20%quartz.

We observed that the cumulative heat increases, in the two slag-quartz cements, with slag content until to reach a plateau for the combination of 20%-slag-20%quartz. In Fig. 1 we can see that higher replacement level of slag does not raise the cumulative heat which suggests that slag reaction becomes limited above a certain optimum (20%slag from Fig.1) . Our SEM analyses further revealed in Fig. 2 that the microstructure is similar in 40% slag and 20%slag-20%quartz: outer products fill almost all the space between grains. These observations indicate that the reactivity of slag is influenced by the space available to fill with outer products. This relation offers new insights on the development of the pore structure in slag-cement system.

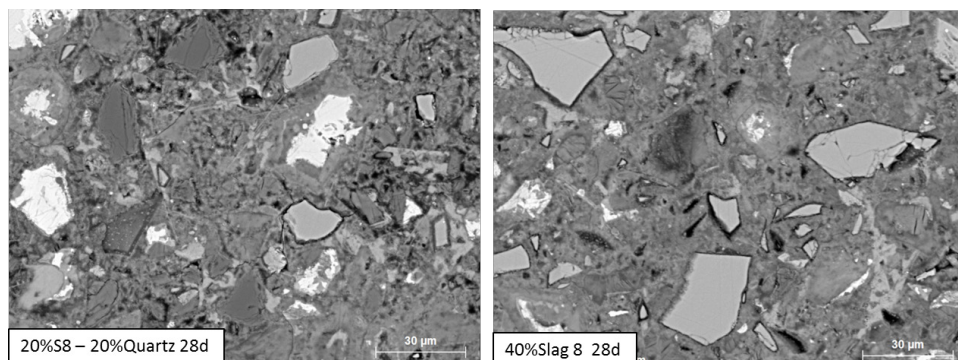


Fig.2 : BSE images of polished section of 20%Slag8-20%Quartz and 40%slag at 28 days

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