



Measuring the Moisture Sorption Kinetics of Cements using DVS

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This note describes the use of DVS technique to differentiate between two different types of cements using moisture sorption kinetics.

Introduction

An important factor in the long-term storage stability of cements is the rate at which moisture is taken up by the cements under specific storage conditions. Traditionally this is done by storing large containers of cement under controlled conditions and periodically weighing over many months or even years. In this application note we measure the moisture sorption kinetics of two different cements using a rapid Dynamic Vapour Sorption (DVS) methodology.

Method

The kinetics of moisture sorption were measured on a DVS automated gravimetric analyser at 40°C and 95% RH using sample sizes of approximately 30mg. Relatively harsh conditions were chosen in order to speed up the reaction kinetics and give a 'worst case scenario' for the moisture uptake.

Results

Figure 1 shows the kinetics of moisture sorption of two different cements at 40°C and 95% RH. The samples were initially dried for one hour at 40°C under flowing nitrogen to obtain the dry sample mass. In both cases the cements showed very little loss of moisture upon drying (<0.1%). The data clearly shows a rapid uptake of moisture for cement 1 at 95% RH, in sharp contrast to cement 2 which appears to have a very long induction period where the moisture uptake is comparatively low. In addition to the gross differences, cement 1 shows subtle variations in the sorption rate above moisture contents of about 11% indicating that there may be complex reactions occurring in the cement at high moisture contents. Both samples have not reached equilibrium after 2 days, with cement 1 sorbing approximately 16% moisture and cement 2 approximately 12% moisture. Although the samples do not reach equilibrium, there is sufficient data to clearly distinguish between the moisture sorption kinetics between the two cements.



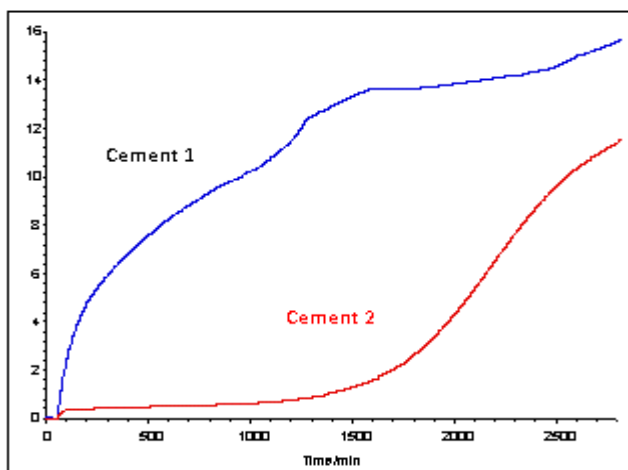


Figure 1. Kinetics of moisture sorption of two cements at 40°C and 95%RH.

Conclusion

DVS may be successfully used to study the moisture sorption kinetics in cements and differentiate between two different types of cement. From the data obtained we may in this case predict that cement 2 should have a much longer storage lifetime than cement 1 which is believed to be a 'quick setting' cement.

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