

Chemistry of cements

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ABSTRACT

The processes during the hydration of Portland cement are well known. The main hydrates formed include C-S-H, portlandite, ettringite, hydrotalcite and AFm-phases such as monocarbonate or monosulfate. Thermodynamic modelling coupled with kinetic equations, which describe the dissolution of the clinker, can be used to predict the composition of hydrated cements as a function of time. In the absence of limestone, ettringite becomes unstable and monosulfate is present after longer hydration times, while in modern Portland cement, where up to 5% of limestone is generally added, ettringite and monocarbonate are formed. Also the temperature has an important influence on the composition of the hydrates. Temperatures of 50 °C and more lead in the long-term to a destabilisation of ettringite and monocarbonate and to the formation of monosulfate. The resulting higher porosity is one of the reasons for the lower compressive strength at higher temperatures. The presence of silica rich supplementary cementitious materials (SCM) such as silica fume, fly ash or slag changes further the composition of the hydrates. Modelling of such blended systems indicates that not only the amount of portlandite decreases but that the lower pH can lead to the destabilization of ettringite and monocarbonate and to the formation of strätlingite.