

Study on the hydration and microstructure of Portland cement containing diethanol-isopropanolamine

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Abstract

Diethanol-isopropanolamine (DEIPA) is a tertiary alkanolamine used in the formulation of cement grinding-aid additives and concrete early-strength agents. In this research, isothermal calorimetry was used to study the hydration kinetics of Portland cement with DEIPA. A combination of X-ray powder diffraction (XRPD), scanning electron microscopy (SEM), differential scanning calorimetry (DSC)–thermogravimetric (TG) analysis and micro-Raman spectroscopy was used to investigate the phase development in the process of hydration. Mercury intrusion porosimetry was used to study the pore size distribution and porosity. The results indicate that DEIPA promotes the formation of ettringite (AFt) and enhances the second hydration rate of the aluminates and ferrite phases, the transformation of AFt into monosulfoaluminate (AFm) and the formation of microcrystalline portlandite (CH) at early stages. At later stages, DEIPA accelerates the hydration of alite and reduces the pore size and porosity.

Keywords: DEIPA; Hydration kinetics; Microstructure; Portland cement