

Effect of the Portland Cement Quality on the Rheology of LC³ Binders Containing Superplasticizers

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Due to the urgent push towards low-CO₂ binders, the development and application of limestone calcined clay cement (LC³) has received significant attention and is gaining momentum. In the early phase of LC³ development, reactivity, mechanical strength and durability issues were intensely studied.^[1] Recently, also the rheological properties of LC³ binders, especially in combination with admixtures, are receiving increasing attention.^[2,3] By addressing the rheological behavior of cementitious materials, both the fresh and hardened properties of concrete can be improved significantly. As the LC³ mixture allows a high substitution of the clinker (up to 50 wt.%), the focus is generally directed towards the impact of the calcined clays and limestone on the rheological properties of LC³ mixes.^[2-4] How the composition of the Portland cement source influences the rheology of LC³ mixes has, however, not been widely reported as of yet.

Therefore, this study investigates the reactivity and rheology of LC³-50 mixes containing various ordinary Portland cements (OPC). The reactivity of the LC³ mixes was characterized using isothermal calorimetry and the rheological properties were studied with a rotational rheometer. Additionally, the influence of a polycarboxylate ether (PCE) dispersant on the OPC pastes and LC³ pastes is evaluated and compared.

The results indicate that the chemical composition and fineness of the OPC plays an important role regarding reactivity and workability of the respective LC³-50 mix, similar as reported for plain OPC.^[4] Furthermore, while PCE-type dispersants allow to reduce the water demand for the OPC as well as the LC³ system, the required PCE dosage is significantly increased for LC³ compared to OPC systems, as highlighted in recent work.^[5]

In conclusion, the types of OPC and PCE have to be taken into account to optimize the rheology of LC³ binders.

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