

The Influence of Partial Replacement of Hydrated Lime by Pozzolans on Properties of Lime Mortars

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Abstract : Hydrated lime, because of the life cycle (return to its natural form as a result of the setting and hardening) has a positive environmental impact. The lime binder is used in mortars. Lime is a slow setting binder with low mechanical properties. The aim of the study was to evaluate the possibility of improving the properties of the lime binder by using different pozzolanic materials as partial replacement of hydrated lime binder. Pozzolan materials are the natural or industrial waste, so do not affect the environmental impact of the lime binder. The following laboratory tests were performed: the analysis of the physical characteristics of the tested samples of lime mortars (bulk density, porosity), flexural and compressive strength, water absorption and the capillary rise of samples and consistency of fresh mortars. As a partial replacement of hydrated lime (in the amount of 10%, 20%, 30% by weight of lime) a metakaolin, silica fume, and zeolite were used. The shortest setting and hardening time showed mortars with the addition of metakaolin. All additives noticeably improved strength characteristic of lime mortars. With the increase in the amount of additive, the increase in strength was also observed. The highest flexural strength was obtained by using the addition of metakaolin in an amount of 20% by weight of lime (2.08 MPa). The highest compressive strength was obtained by using also the addition of metakaolin but in an amount of 30% by weight of lime (9.43 MPa). The addition of pozzolan caused an increase in the mortar tightness which contributed to the limitation of absorbability. Due to the different surface area, pozzolanic additives affected the consistency of fresh mortars. Initial consistency was assumed as plastic. Only the addition of silica fume an amount of 20 and 30% by weight of lime changed the consistency to the thick-plastic. The conducted study demonstrated the possibility of applying lime mortar with satisfactory properties. The features of lime mortars do not differ significantly from cement-based mortar properties and show a lower environmental impact due to CO₂ absorption during lime hardening. Taking into consideration the setting time, strength and consistency, the best results can be obtained with metakaolin addition to the lime mortar.

Keywords : lime, binder, mortar, pozzolan, properties

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