The Influence of Wastes Materials on the Rheology of Rendering Mortars

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Abstract:
The objective of this paper is to present the results of a research about the effect of mineral additions and specific lightweight aggregates obtained from wastes materials (crushed EPS and cork) on the rheological properties of renderings mortars. Four series of mortar formulations were prepared. Each series was composed by four mortars mixes with different mineral additions: hydrated lime, glass powder, tungsten mine waste mud, and metakaolin. The proportions of the mortars expressed in terms of apparent volume of cement, mineral addition and sand was 1:1:5. Flowability of mortar was measured using a standard flow table test. The density and the water retention capacity of mortars were also determined. The mortar rheological parameters were evaluated using a rheometer. The results show that the mortar yield stress is strongly influenced by the water amount, binder fineness and mineral addition nature. The mortars plastic viscosity is also influenced by the nature of mineral addition and the partial replacement of sand by EPS aggregates introduce incongruent values, caused by the segregation, in the mortar yield stress, whereas, the cork aggregates is responsible by the yield stress reduction.

Zusammenfassung:
Die Zielsetzung dieses Artikels ist, Forschungsresultate zu präsentieren über den Einfluss mineralischer Zusatzstoffe und spezieller Aggregate mit niedriger Dichte aus Abfallmaterialien (zerkleinertes EPS und Kork) auf die rheologischen Eigenschaften von Putzmörtel. Vier verschiedene Mörtelformulierungen wurden untersucht. Jede Formulierung bestand aus vier Mörtelmischungen mit unterschiedlichen mineralischen Additiven: hydratisierter Kalk, Glaspulver, Wolframminenabbaulehm und Metakaolinit. Die Zusammensetzung (scheinbare Volumenanteile von Zement, mineralischen Additiven und Sand) des Mörtels war 1:1:5. Die Fließfähigkeit des Mörtels mit Hilfe des Standardfließtischtests wurde gemessen. Die Dichte und das Rückhaltevermögen bzgl. Wasser wurden ebenfalls bestimmt. Die rheologischen Eigenschaften des Mörtels wurden mit Hilfe eines Rheometers bestimmt. Die Ergebnisse zeigen, dass die Fließspannung des Mörtels stark durch den Wasseranteil, die Feinheit des Binders und die Natur der mineralischen Additive beeinflusst wird. Die plastische Viskosität des Mörtels wird auch durch die Natur der mineralischen Zusatzstoffe beeinflusst, und der partielle Ersatz des Sandes durch EPS-Aggregate führt nichtübereinstimmende Werte ein, verursacht durch Segregation in der Fließspannung des Mörtels, wohingegen die Korkaggregate für die Reduktion der Fließspannung verantwortlich sind.

Résumé:
L'objectif de cet article est de présenter les résultats d'une recherche sur l'effet des additions minérales et des granulats légers obtenus à partir de matières de déchets (Polystyrène expansé EPS et le liège) sur les propriétés rhéologiques des mortiers. Quatre séries de formulations de mortier ont été préparées. Chaque série a été composée de quatre mélanges avec différentes additions minérales: chaux hydratée, poudre de verre, boue de déchets de mine de tungstène et metakaolin. Les proportions des mortiers exprimées en termes de volume apparent du ciment, du sable et d'addition minéral est 01:01:05. L'ouvrabilité du mortier a été mesurée en utilisant la table à secousses. La masse volumique apparente et la capacité de rétention d'eau des mortiers ont également été déterminées. Les paramètres rhéologiques du mortier ont été évalués à l'aide d'un rhéomètre. Les résultats montrent que le seuil de cisaillement du mortier est fortement influencé par la quantité d'eau, par la finesse et la nature de l'addition minérale, qui modifie aussi la viscosité plastique des mortiers. Le remplacement partiel du sable par des agrégats EPS introduit des valeurs incongrues, causées par la ségrégation, dans le seuil de cisaillement du mortier, tandis que les granulats de liège sont responsables de la réduction du seuil de cisaillement du mortier.

Key words: cement-based mortar, mineral additions, wastes materials, flowability, rheology

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dence trend between the flow spread diameters and yield stress is observed, i.e. the highest values of yield stress is linked to the lower spread diameters. These results constitute practical information for interpreting the effect of wastes additions and wastes lightweight aggregates on the mortar workability and their rheological parameters.

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