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12th ACI/RILEM International Conference on Cementitious Materials and Alternative Binders for Sustainable Concrete

Abstract Guidelines

1) **Abstract title**
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3) **Abstract of up to 200 words written at least at 1.5 spacing.**

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TITLE

Micro-Chemo-Mechanical Effects of Supplementary Cementitious Materials on Cement Matrices Investigated By Combined Statistical Nano-Indentation (SNI) and SEM-EDS Analyses

Key topic: Microstructure and hydratation

AUTHORS

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ABSTRACT

Although ordinary Portland cement (OPC) has unique hydration properties, current sustainability concerns drive an increased use of supplementary cementitious materials (SCMs) to partially replace OPC. This study investigates the effects of different SCMs (e.g., fly ash, metakaolin, glass powder, or natural pozzolan) on the microstructure of hardened cement matrices, with the aim of disclosing the mechanisms of strength development specific to each SCM. Polished surfaces of cement pastes were investigated using statistical nanoindentation (SNI) coupled with energy dispersive X-ray spectroscopy (EDS) on the scanning electron microscope. As illustrated in Fig. 1, this combination of chemo-mechanical methods allows the mapping and statistical clustering of phases to determine average micro-chemomechanical properties for both the hydrated and anhydrous phases. The results provides new insights on the impact of selected SCMs on the chemistry and mechanical properties of the binding hydrates (e.g. the calcium-[aluminum]-silicate hydrates, C-[A]-S-H). Analyzing the results of SNI-EDS by micromechanics for highvolume-SCM systems showed the importance of the micro-granular skeleton of hard anhydrous inclusions on the hardness and, in turn, on the mechanical strength. The multi-technique method applied in this study to binary systems allow disclosing microstructure knowledge which is key for efficiently engineering highly heterogeneous cementitious systems, e.g., ternary blends.