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Interfacial Transition Zone of Cement Composites with Steel Furnace Slag Aggregates

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Abstract

As previous studies of mortar and concrete with steel furnace slag (SFS) aggregates have shown increases or decreases in the bulk mechanical properties, this study investigated the microstructural cause of these opposing trends through characterization of the interfacial transition zone (ITZ) with quantitative image analysis of backscatter electron micrographs. Three SFS types – basic oxygen furnace (BOF), electric arc furnace (EAF), EAF/ladle metallurgy furnace (EAF/LMF) – were examined as aggregates in a portland cement mortar. The ITZ size for all SFS mortar mixtures was similar, with the ITZ of BOF and EAF/LMF being slightly more porous than mortar mixtures with EAF or dolomite. Microstructural examinations of the SFS particle revealed that BOF and EAF/LMF aggregates have different outer and interior compositions, with the outer composition consisting of a porous layer, which likely contributes to the reduced strength relative to EAF. The imaging results demonstrated that the type of SFS and its spatial composition greatly influences the bulk properties of mortar and concrete, mainly as a function of porosity content in the ITZ and the outer layer and interior porosity of the SFS aggregate.

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