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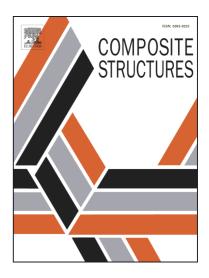
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ACCEPTED MANUSCRIPT

An assessment of microcracks in the Interfacial Transition Zone of durable

concrete composites with fly ash additives

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Abstract

This paper presents results of tests on the effect of the addition of fly ashes (FA) in the amount

of: 0, 20 and 30% by weight of cement on the size of microcracks in concrete composites. The

analyses were carried out based on the results of the microstructural tests, by using Scanning

Electron Microscope (SEM). During investigations the size of microcracks occurring in the

Interfacial Transition Zone (ITZ) of coarse aggregate with cement matrix was evaluated. In the

own testing, it was demonstrated that addition of FA modifies the microstructure of the ITZ.

Composites with FA at early age are characterized by greater microcrack width in the ITZ in

comparison to the unmodified concrete. In matured concretes the smallest microcracks occur in

composite with the 20% FA additive. It can be concluded that the mature composites with 20%

addition of FA are characterized by low permeability and therefore high durability.

Keywords: concrete composite, siliceous fly ash, Interfacial Transition Zone (ITZ), microstructure,

microcrack, Scanning Electron Microscopy (SEM).

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1. Introduction

Increasing demands for durability and strength of cement-based composites have made it

essential to introduce Supplementary Cementitious Materials (SCMs) into the Ordinary Portland

Cement (OPC) [1]. These materials can be divided generally into 6 classes (Table 1), i.e.:

industrial wastes, nano industrial wastes, agriculture-farming wastes, agaculture-farming wastes,

natural minerals, dust and powders. Moreover, each class contains several types of SCMs (Table

1), e.g. [2-13]. One of SCMs is siliceous Fly Ash (FA). In OPC, the FA produces a conciderable

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