بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

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Ain Shams University

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Behavior of Steel Slag Concrete Subjected to Elevated Temperature

By

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B.Sc. Civil Engineering

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A Thesis

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Key words: Steel slag, EASS, Granulated slag, Residual strength.

Abstract

Recycling of materials has become a major interest for engineers as a part of their collective efforts in finding and developing environmentally friendly solutions towards a more sustainable future. As a result of the rapid growth in the steel industry, at present the amount of slag deposited in storage yard adds up to thousands of tons, leading to the occupation of farm land and serious pollution to the environment.

One of the promising solutions is using steel slag as aggregates in concrete. For instance, the steel slag can be used as fully or partially replacement of the natural coarse and fine aggregates in the conventional concrete. This solution can be considered as a one step forward towards sustainable construction to reduce the amount of steel slag landfills and conserves the natural resources.

Electric arc furnace slag is formed from manufacturing of stainless and high alloy steel. In this process scrap with alloys is melted to stainless or special steel by electrical and chemical energy. The slag is prepared by reducing agents and the addition of fluxes, aluminum or silicon compounds, dolomite and/or lime). The liquid slag which has produced at temperatures of around 1600^{o}C .this slag is controlled and treated if necessary, to improve the physical properties of the slag. Then, the slag is cooled under controlled conditions in pits or pots forming crystalline texture of slag.

This by-product can be broken down to smaller sizes to be used as aggregates in asphalt and concrete. In the current research, locally produced EAF steel slag in Egypt was used to enhance concrete properties subjected to elevated temperatures. Several studies reported that using steel slag increase the compressive strength and decrease absorption and drying shrinkage of concrete. Also, the using of steel slag

reduces the concrete workability when the percentage of slag replacement increase up to 30% and need super plastizers. The shape and texture of steel slag particles significantly improve the tensile strength of concrete due to its better bond with cement paste. Nevertheless, there are small number of researches conducted to investigate the behavior of concrete with steel slag coarse aggregate when subjected to fire or elevated temperature.

Therefore, the focus of this study is to investigate the behavior of concrete with steel slag aggregate when subjected to elevated temperature. Test results of the slag properties were provided Electric arc furnace slag (EAFS) having water absorption of 0.81%, aggregate crushing value of 16.04%, aggregate impact value of 11.13% and abrasion of Los-Angeles of 22.43% was suitable to be employed as aggregate in cement-based applications compared to natural aggregates. Studies proved that compressive strength increased 16% at the temperature of 400°C when using steel slag as coarse aggregate. Total replacement of coarse aggregate with EAF slag improves concretes mechanical properties, including compressive, tensile strength and elastic modulus.

In this study, the behavior of granulated slag as partial or full coarse aggregates replacement in concrete subjected to elevated temperature will be discussed by using six groups, each group consisted of concrete mixtures with slag replacement percentages of 0%, 15%, 30%, 50%, and 100% which exposed to temperatures of 400°C, 600°C and 800° C in duration of exposure 1hr, 1.5hr, and 2hr.

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