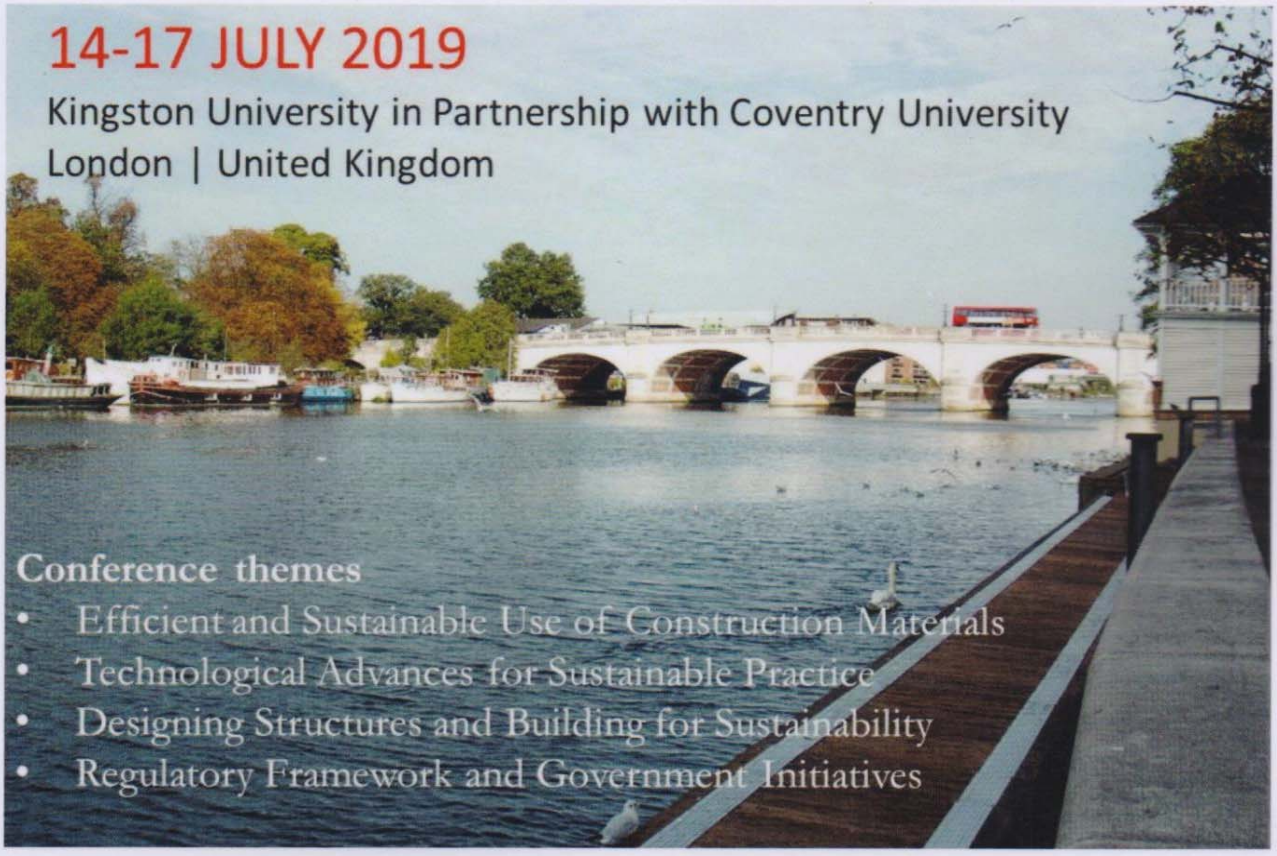
Fifth International Conference on Sustainable Construction Materials and Technologies (SCMT5)



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Volume 2

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Table of Contents

Page

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Sustainable Construction Materials and Technologies
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Fracture toughness evaluation of fiber-reinforced concrete manufactured with siderurgic aggregates.

(Conference Paper)

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Abstract

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Steel production in electric arc furnaces generates a principal waste stream in the form of Electric Arc Furnace Slag (EAFS), also known as "black slag". The well-researched and advantageous properties of EAFS guarantee its successful use as aggregate in the manufacture of concrete (CEAFS). In contrast, fiber-reinforced concrete is widely employed, especially in concrete pavements and slabs, for improved cracking resistance and "ductile" post-cracking behavior. In this research, the toughness and ductile behavior of these fiber-reinforced CEAFS is tested with various methods, using different types of (metallic and synthetic) fibers in EAFS mixes. The metallic fiber concretes showed better results than the fiber concretes in terms of toughness, first-crack strength, limit of proportionality, and post-cracking behavior. The recycling process of EAFS makes a relevant contribution to the circular economy and therefore to global sustainability. © 2019 Institute of Electrical and Electronics Engineers Inc.. All rights reserved.

Author keywords

Cracking resistance | Fiber-reinforced concrete | Fracture toughness | Slag

Indexed keywords

Engineering controlled terms: Aggregates | Concrete aggregates | Concrete products | Cracks | Electric arcs | Electric furnace process | Electric furnaces | Fiber reinforced materials | Fibers | Fracture toughness | Particulate emissions | Reinforced plastics | Slags | Steelmaking furnaces | Sustainable development

Engineering uncontrolled terms: Circular economy | Cracking behavior | Cracking resistance | Electric arc furnace | Electric arc furnace slags | Fiber-reinforced concretes | Global sustainability | Recycling process

Engineering main heading: Reinforced concrete

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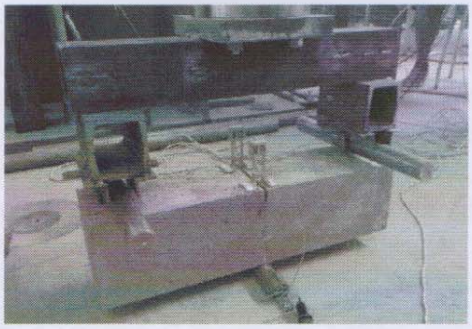

Figure 5. Arrangement of specimen after cracking in flexural tensile strength test

Table 6. LOP and residual tensile strength after cracking

Flexural tensile strength test EN-14651 standard		E	EM2	ES1
LOP (CMOD ≤ 0.05 mm) (MPa)		6.1	6.4	6.2
Residual flexural tensile strength (MPa)	0.5 mm	-	5.5	1.5
	1.5 mm	-	5.4	1.1
	2.5 mm	-	5.1	1.1
	3.5 mm	-	4.7	1.2

4. CONCLUSIONS.

- Siderurgic concrete mixtures reinforced with either metallic or synthetic fibers showed good mechanical properties.
- The toughness and post-cracking behavior of siderurgic concretes reinforced with fibers (metallic or synthetic), evaluated under compressive and flexural tests (with and without initial notching) and with the Barcelona Method, were suitable for the use of these concretes in pavements and industrial slabs.
- The best siderurgic concrete evaluated in this study was the mixture reinforced with a volume of metallic fiber at 0.6% by volume of concrete.

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