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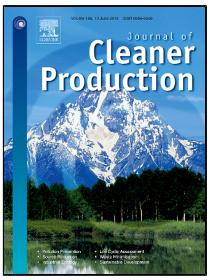

Micro-mechanical Analysis and X-ray Computed Tomography Quantification of Damage in Concrete with Industrial By-Products and Construction Waste

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Micro-mechanical Analysis and X-ray Computed Tomography Quantification of Damage in Concrete with Industrial By-Products and Construction Waste

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Abstract

Increasing quantity of industrial by-products and construction and demolition waste are emerging as a potential source of environmental and health hazards. The utilisation of these wastes in the concrete industry as aggregate is a reasonable option for conservation of diminishing natural aggregate resources and for reducing landfill usage which, in turn, yield significant economic and environmental benefits. The structural and functional behaviour of concrete is highly dependent on the internal micro-structure (i.e. the content and size of voids). Traditional tests for the observation of concrete micro-structure are time consuming and destructive in nature and may also alter the micro-structure. However, the non-destructive imaging and characterization of concrete micro-structure using the X-ray computed tomography technique is an innovative and promising method to determine the actual damage mechanism under loading and hence to provide a basis for enhancing the performance. To promote the use of unconventional coarse aggregates in cementitious materials, the authors carried out experiments on concrete mixtures containing 100% unconventional aggregates, either industrial by-products (sintered fly ash, crumb rubber and copper slag) or C&D waste (blue brick), as replacements for normal coarse aggregates in concrete and, to determine the mechanical performance and non destructive properties of concrete containing these