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Mechanical properties of concrete containing recycle concrete aggregates and multi-walled carbon nanotubes under static and dynamic stresses

Allujami, Hamzeh Marwan[a]; Abdulkareem, Muyideen[a] ✉; Jassam, Taha M.[a]; Al-Mansob, Ramez A.[b]; Ibrahim, Azmi[c]; Ng, Jing Lin[a]; Yam, Hok Chai[d]

Save all to author list

[a] Civil & Environmental Engineering Department, UCSI University, Kuala Lumpur, 56000, Malaysia
[b] Dept. of Civil Engineering, International Islamic University Malaysia (IIUM), Gombak, Malaysia
[c] Faculty of Civil Engineering, Universiti Teknologi Mara, Selangor, Shah Alam, 40450, Malaysia
[d] Department of Biotechnology, Faculty of Applied Sciences, UCSI University, Kuala Lumpur, 56000, Malaysia

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Abstract
Author keywords
Indexed keywords
SciVal Topics
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Abstract

The growing demand for natural aggregates in the construction industry has motivated researchers to utilize recycled concrete aggregates (RCA) to preserve the natural resources and provide sustainable structure. However, the use of RCA in concrete applications has revealed defects in performance with low strength and rapid collapse under static and dynamic loads, respectively.

Thus, the objective of present research is to improve these properties by using multi-walled carbon nanotubes (MWCNT). This study involves evaluating the fresh and hardened properties of recycled aggregate concrete (RAC) modified with different levels of MWCNT. The study involves RCA (i.e., 0 %, 25 %, 50 %, 75 % and 100 %) as replacement for natural aggregates , and MWCNT (i.e., 0.05 %, 0.1 % and 0.25 %) as weight of cement. The experimental testing consists of 240 specimens prepared from different mixtures. Workability is assessed using slump tests. Mechanical properties including static compressive strength and dynamic impact resistance are evaluated at 7 and 28 days. Experimental results show that incorporating MWCNT at all levels significantly reduces the slump values for all specimens. On the other hand, the compressive strength is increased by adding MWCNT to the concrete samples. The compressive strength of the RAC increased by as much as 70 % when modified with MWCNT. Furthermore, the inclusion of MWCNT is found to significantly increase the impact resistance of RAC specimens with percentage developments reaching approximately 11–508 % and 110–679 % at 7 and 28 days, respectively, at both first crack and failure stages. The dosage of 0.1 % MWCNT is shown to exhibit the highest percentage enhancement in impact resistance among the other nano levels. The failure patterns and cracks propagation are presented as well. © 2022

Author keywords

Compressive strength; Impact resistance; Multi-walled carbon nanotubes ; Recycled aggregates concrete ; Workability

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Abdulkareem, M.; Civil & Environmental Engineering Department, UCSI University, Kuala Lumpur, Malaysia; email:abdulkareem@ucsiuniversity.edu.my

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