بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

USE OF NANOTECHNOLOGY TO IMPROVE THE RESTORATION OF HERITAGE BUILDINGS

(SYNDICATE OF ENGINEERS BUILDINGS AS A MODEL)

Submitted By

Michael Girgis Adly Girgis

B.Sc. of Engineering, Higher Institute of Engineering, Shorouk Academy, 2010

A Thesis Submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Engineering Sciences
Institute of Environmental Studies and Research
Ain Shams University

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APPROVAL SHEET

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DEDICATION

To my father as he has always been encouraging me to start my Master's degree, Allah with him, my mother who registered for me for my postgraduate studies and prays for me to succeed in my work, and my daughter Carla who is the hope and future I wish her a happy life. I cannot forget to thank my wife who supported and helped me. I also would like to thank all my family,

ALLAH WITH THEM.

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In the name of the one Allah that we all worship

I start with thanking Allah for giving me the passion to learning and knowledge as well as the hope that difficulties within my work will end with joy. I thank Allah who gave me success to finish this thesis.

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Prof. Dr. Magda Ekram Ebeid & Prof. Dr. El-Saaid Ibrahim Zaki

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ABASTRACT

Nanotechnology is an advanced technology based on the understanding and studying of nanoscience and other basic sciences with the ability of this technology to manufacture nanomaterials and control their internal structure by restructuring and arranging atoms and their constituent molecules, thus ensuring access to unique products to be used in applications advanced in sustainability and green buildings. Products and applications of nanotechnology in buildings provide architectural solutions to all environmental problems and improve building efficiency throughout the building life cycle.

In this research program look at the maintenance of buildings to maintain sustainability using nanotechnology materials in the restoration of structural elements, including nano-calcium carbonate ($NCaCo_3$) and nano-kaoline (NK), and show their effect on reinforced concrete elements.

Heritage buildings are buildings of historical, symbolic, artistic, architectural, or social value. They should be characterized by the acceptance of society, by cultural and social phenomena, and by steadfastness and continuity. They are divided into three categories: (a) they are restored without internal or external modifications; or (b) internal modifications are allowed; or (c) the amendment shall be made available while preserving the outer structure. In this study, the building that shall be applied to is the Egyptian Engineers Syndicate.

- There is the manufacture of two types of nanoparticles, nano-calcium carbonate ($CaCo_3$) and nano-kaolin by thermal activation

up to 800 C^0 for 2 hrs. The use of two types of nanoparticles with different proportions in the concrete used to restore the structural elements is studied within this research.

The nano-$CaCo_3$ was added at percentages of 1, 2, and 3% as a partial replacement of cement, while NK was added at percentages of 5, 6, and 7%. In addition, a hybrid was made by 1% NCa + 5%NK and 0.5% NCa + 4.5% N., All mixes were added to old concrete that represents the concrete that needs to be restored, The experiment results show that adding these nanomaterials reduces the workability of concrete significantly.

The compressive strength of concrete mixes was improved by 12% to 19% of normal concrete; in addition, the microstructure of nanomixes was improved compared to the control mixture and the optimum amount of nano-$CaCo_3$ is 1%, NK is 5%, and hybrid is (0.5% NCa + 4.5% NK), respectively. Water permeability was also improved for nanomixes in comparison with control ones.

The ideal ratio of nanomaterials for the fit of the restoration was HN_2 (0.5% NCa + 4.5% NK), which increases the hardening process at early ages and achieves the best compressive strength test results and adhesion with old concrete.

-Keywords: - Heritage – Nanomaterial – Restoration –Hybrid nano –Nano kaoline – Nano $CaCO_3$.

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