出國報告（出國類別：國際會議）

出席第二十四屆複合/奈米工程年度國際會議

服務機關：國立嘉義大學
姓名職稱：吳振賢講師
派赴國家：中國大陸
出國期間：105 年 10 月 7 日至 11 日
報告日期：106 年 03 月 15 日

摘 要

複合/奈米工程年度國際會議（International Conference on COMPOSITES/NANO ENGINEERING ,ICCE）係由新奧爾良大學機械工程系大衛·許教授（會議主席）也是複合材料 B 期刊主編（影響因子 2.983）（Editor in Chief Composites B journal,impact factor 2.983）發起主辦。每年在世界各國不同地區辦理研討會。今年選在中國海南島海口市辦理 7 天的研討會。本次會議共發表論文二百餘篇。

關鍵詞：奈米、複合材料

目 次

壹、 計畫緣起與目的

ICCE 會議是獨一無二的工程會議，它吸引了來自不同領域的許多化學家，物理學家和科學家在努力促進複合材料的跨學科研究。特別關注的是材料工程師理解從納米到微米到宏觀和全尺度的長度尺度的多樣性並且質疑已知僅在某些長度尺度上有效的理論或模型的有效性的挑戰。 ICCE 是首批複合材料會議之一，在彌合納米化學和納米工程之間的差距方面發揮了領先的重要作用，並吸引了數百篇論文在這個現有的相對較新的納米複合材料工程領域。ICCE 會議將爲在幾乎所有領域的複合材料研究中交流信息和想法提供一個論壇。 ICCE 會議的目標是：

1.會議旨在解決或部分解決我們日常生活的關鍵未解決問題。該方法涉及復合材料或納米工程中的三個支柱，即力學，製造和材料，所有長度尺度。

2. ICCE 強調了科學和工程的“DIM”方法（對結構的 DURABILITY 方法，對科學的 INTERDISCIPLINARY 方法和對材料的多功能方法）。因此，在這次會議上，會發現許多化學家和工程師。ICCE 會議旨在彌合航空航天技術，生物材料，化學，電子，能源，流體力學，基礎設施，磁性材料，冶金，納米技術，製藥，物理，粉末冶金等領域。

3.通過參與者之間的聯合研究和編寫聯合研究建議，激勵複合材料研究資源的利用。

貳、參加研討會過程與內容

依據研討會議程 7 月 17 日~23 日，筆者只參 19 日~23 日會議，行程如下；

7 月 19 日啓程 台北桃園機場直飛中國海口市機場及研討會報到。

7 月 20 日參加 ICCE 國際會議

7 月 21 日參加 ICCE 國際會議

7 月 22 日參加 ICCE 國際會議

7 月 23 日由中國海口市返台

圖 1 筆者在研討會結束晚會與大會
主席 Dr. David Hui 合影

圖 2 論文發表情況

圖 3 研討會場外

在參與本次研討會相關研討，筆者認爲有三篇非常值得國內參考的論 文，概述如下:

一、強化混凝土樑的界面缺陷臨界(The Interfacial Defect Criticality Of FRP Strength-ened Concrete Beams)

發表人:Ao Zhou, Denvid Lau (City U. Hong Kong, China)

這個研究主要是在探究粘合纖維增強聚合物（FRP）已被證明是一種有效和高效的方法加強和/或改進不足的混凝土構件和結構。界面缺陷可能容易在設計的使用壽命期間由於不適當的結構或環境惡化而產生它們可能對 FRP 鍵合的局部鍵合行爲和整體性能產生不利的影響混凝土系統。然而，關於界面缺陷效應的信息和區分的指南界面缺陷的臨界性受到限制，使得難以評估長期誠信。在這項研究中，含有各種界面缺陷的 FRP-粘結混凝土梁在四點以下彎曲試驗以評價缺陷效應並確定界面缺陷臨界性位置和大小方面。同時，有限元模型代表不同尺寸的 FRP 鍵合混凝土梁建造和模擬研究樑的尺寸效應。兩者的實驗觀察並且數值結果表明，深梁對界面缺陷的敏感性高於正常光束。臨界界面缺陷的閾值根據光束類型顯著變化和缺陷位置。小，中，大類界面缺陷可以根據分類到光束類型，缺陷位置和缺陷尺寸。不同的維護策略應適應小，中，大界面缺陷。界面缺陷從本研究中揭示的關鍵性可以提供檢測缺陷時的維護指南並且可以有利於更精確的性能評估和使用壽命預測 FRP 結合混凝土結構。

圖 4 發表論文

二、具有形狀記憶合金的混凝土柱的機械和實驗分析(Mechanical and Experimental Analysis of Concrete Columns With Shape Memory Alloy Reinforced)

發表人: Jing-Biao Liu, Xiao-Yu SUN, Zhen-Qing Wang, Li-Dan Xv (Harbin Inst.Tech., China)

形狀記憶合金（SMA）是一種新型功能材料，並且已經在許多領域中得到了越來越多的應用。最近，研究工作已擴展到使用 SMA 來控制民用結構。本文介紹了 SMA 材料在土木結構被動，主動和半主動控制中的應用。首先，提出了 SMA 的特性的概述。形狀記憶效應（SME）和假彈性，SMA 的兩個主要性質與熱誘導或應力誘導的可逆的滯後相變奧氏體和馬氏體之間相關。這些獨特的性能使 SMA 能夠用作用於土木結構混凝土柱。研究使用基於 SMA 的設備被動，半主動或主動控制民用混凝土柱結構。這些基於 SMA 的設備的操作機制，設計和實驗結果也在本文中提出。

三、鋼纖維增強混凝土的等效彎曲強度具有不同的混凝土強度 (Equivalent Flexural Strength Of Steel Fiber-Reinforced ConcreteWith Different Concrete Strength)

發表人:Jong-Han Lee (Daegu U., Gyeongsan, S.Korea), Baiksoon Cho (Inje U., Gimhae, S. Korea), Eunsoo Choi (Hongik U., Seoul, S. Korea)

鋼纖維鋼筋混凝土作爲結構材料日益日益被使用。處於壓縮狀態的材料的完整應力 - 應變曲線對於結構的分析和設計是需要的。在該實驗研究中，已經嘗試爲不同的混凝土抗壓強度的鋼纖維增強混凝土實驗產生完整的應力 - 應變曲線。研究了纖維添加對混凝土的一些主要參數，即峰值應力，峰值應力下的應變，混凝土的韌性和應力 - 應變曲線的性質的影響。提出了一種簡單的分析模型來生成應力- 應變曲線的上升和下降部分。還提出了等式來量化纖維對抗壓強度，峰值應力下的應變和混凝土韌性在纖維增強參數方面的影響。

參、心得與建議

複合/奈米工程年度國際會議目的爲便於研究人員和工程師交流創新理念和對生物啓發（奈米）發展的最新研究成果，該會正在組織仿生複合/奈米在 ICCE24 特殊的專題討論會之一。近年來，仿生奈米複合材料不平凡的業績已經用於複製在自然界中發現了前所未有的性能和功能的機制刺激仿生多元化途徑的各種引

人入勝的方式引發極大的興趣和探索。其發展已經導致設計和的具有新穎性質和/或分層的先進功能（奈米） - 材料/複合材料，以及在生物傳感，自我修復，自組裝，藥物遞送領域的潛在用途製造，人工骨，新型功能器件和結構的生物醫學和磁系統等領域的應用。ICCE-24 的目標是：（1）跨越材料科學，力學和材料科學之間的差距複合材料製造，（2）鼓勵跨學科研究，以及（3）通過參與者之間的聯合研究，鼓勵研究資源利用。熱門主題有可持續性材料，氧化物和異質結構，材料化學，生物物理，生物醫學，生物納米，能源納米，能源存儲和轉換，碳科學技術，3-D 印刷，惡劣環境下的材料，綠色材料，混合動力和多功能材料，和其他。傳統主題爲材料科學的所有領域，力學和固體物理的所有領域，結構，製造，數學建模，基礎設施複合材料，氧化物，物理，化學，生物學的複合材料，計算材料，智能材料和傳感器等。

肆、附錄

附錄一 論文通知信函

-----Forwarded message-----
From: David Hui <DHui@uno.edu>
To: mtlee <mtlee@mail.ncyu.edu.tw>
Date: Wed, 04 May 2016 06:58:10
Subject: RE: Composites B journal 25th Celebration & ICCE

EFFECTS OF PARTIALLY OXIDIZED CRUMB RUBBER ON THE HYDRATION OF C3S: FTIR SPECTRA STUDY

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dear Maw-Tien

Two pager received

Your two-page short paper was received and is found to be accepted in ICCE-24 Proceedings
as oral paper in the ICCE-24, July 17-23, 2016 in Hainan Island,.China.

You are encouraged to inform as many professors or students as possible to present papers or develop sessions at this conference.
Submission of two-page short paper implies you agree to pay the registration fee and present the paper at the conference.

To avoid surcharge, we allow only one paper per presenter. We will send you the registration form and hotel information.

David Hui
Chair ICCE-24, July 17-23, 2016 in Haikou, Hainan Island,.China
Editor in chief Composites B journal
May 3, 2016

附錄二 發表論文內容

EFFECTS OF PARTIALLY OXIDIZED CRUMB RUBBER ON THE HYDRATION OF C3S: FTIR SPECTRA STUDY

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Introduction

Cement based materials are widely used in construction. However, the friable characteristic of these materials is an important problem to be solved. The addition of organic polymers, such as plastics or rubber, to cement based materials to produce a cement matrix composite could be a feasible way for solving this problem. However, it is a generally accepted result that the inclusion of organic polymers will induce the degradation of the physical and mechanic properties of concrete. To conquer this problem, Chou et al treated the crumb rubber with partial oxidation method to modify crumb rubber surface properties and succeed in enhancing the bonding interaction between crumb rubber and cement hydration products. Because the tricalcium silicate ($3CaO.SiO_2$, C3S) is the major composition of cement, and the hydration product of C3S with water, hydrate (calcium silicate hydrate C-S-H) is the main strength source of these materials, it is necessary to understand the effect of crumb rubber on the hydration of C3S for further improving the rubberized concrete.

In this study C3S was prepared by sol-gel method. The partially oxidized crumb rubber was treated by controlling oxygen content and reaction temperature as described by Chou et al. The as-received and partially oxidized crumb rubbers were added to the C3S individually to prepare the pastes for further characterizing. Fast Fourier Transform Infrared Spectroscopy (FTIR) was used to explore the functional groups between the crumb rubber and the hydration products.

The experimental results showed that the addition of crumb rubber could induce the blue shift of the IR absorption of C-S-H, and that the addition of partially oxidized crumb rubber had less effect on the hydrate of C3S than that of the as-received crumb rubber.

Materials and methods

Materials:

1) Calcium nitrate: $Ca(NO_3)_2.4H_2O$, Sodium metasilicate: $Na_2SiO_3.5H_2O$, and crumb rubber: with diameter of 300 ~ 600µm.

Procedure:

1) Synthesis of C3S: $Na_2SiO_3.5H_2O$ (0.1M, 200ml) was mixed with 20ml, 10M NaOH and then added dropwise to 0.19M, 200ml of $Ca(NO_3)_2.4H_2O$ solution, and then left to settle over night. The C-S-H colloidal solution was dried and ground into powder. The powder was calcined at 1400 ℃ to become C3S for further use.
2) Treatment of crumb rubber: The crumb rubber was treated as reference (Chou et al) to produce hydrophilic function on its surface.
3) Reaction of C3S with crumb rubber: Both as-received and partially oxidized crumb rubbers (6 % by weight) were added to C3S individually and mixed with water (keeping w/c=0.5). The samples were analyzed with FT-IR after seven days.

Results and Discussion

Figure 1 is the IR spectra of cement, C-S-H gel, and C3S. The signals near wave-number 1500 are CO_2 spectrum, and the signals near wave-number 1000 and 900 are C-S-H spectra. CO_2 comes from air. Because we just wanted to observe the effect of crumb rubber on the production of C-S-H in the short term period, we did no purge air from our experimental apparatus. It is clear that cement, C-S-H gel and C3S adsorb the same wave-number IR near the regions of wave-number 1000 and 900. Figure 2 gives the differences of the hydrates of the pure C3S, C3S with as-received crumb rubber, and C3S with partially oxidized crumb rubber. In comparison the spectra of C3S and that of C3S with crumb rubber, the addition of crumb rubber induced the blue shift 10 to 15 wave-number. It implies that some substances existed around C-S-H. Further information shows, that the as-received crumb rubber induced the reduction of the absorption intensity of C3S, however, C3S with partially oxidized crumb rubber had less effect on the reduction effect. It is believed that the addition of partially oxidized crumb rubber has less effect on the hydration of C3S than that of the as-received crumb rubber.

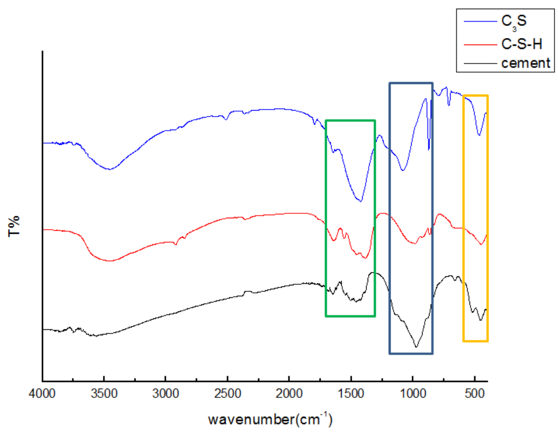

Figure1 FTIR spectra of cement, C-S-H, C3S

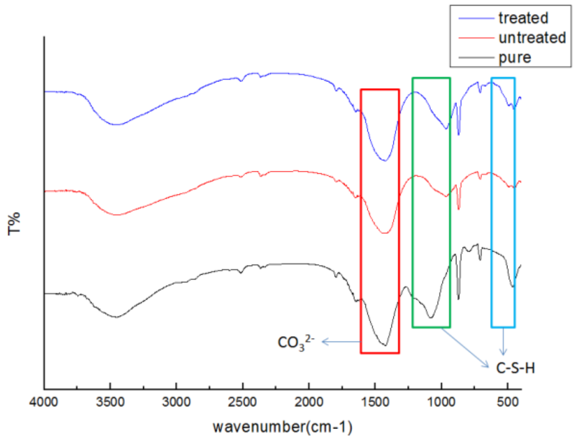

Figure2 FTIR spectra of C3S, C3S with as-received rubber, and C3S with treated rubber

Conclusions

The addition of as-received crumb rubber will affect production of C-S-H of C3S and the interaction between rubber and C-S-H. However the addition of partially oxidized crumb rubber has less effect on the hydration of C3S than that of the as-received crumb rubber.

References:

1)Liang-Hsing Chou, Cho-Kun Yang, Maw-Tien Lee, Chia-Chen Shu Effects of partial oxidation of crumb rubber on properties of rubberized mortar, Composites: Part B.41. 613–616(2010).