

行政院原子能委員會  
委託研究計畫研究報告

高完整性承裝容器製程自動化研究

計畫編號：952001INER021

受委託機關(構)：國立台灣大學

計畫主持人：黃兆龍

核研所參與人員：黃兆龍 黃慶村 張清土

聯絡電話：(02)-27353950

E-mail address：cmrl@seed.net.tw

報告日期：95 年 12 月

## 中文摘要

近代混凝土技術中，為了因應地形氣候及不同結構外形等影響，新的混凝土設計構思不斷推陳出新，對混凝土材料的強度、工作性、耐久性等亦有了更高的要求，因此優生混凝土(EC)或高性能混凝土(HPC)的應用也越來越廣泛。而纖維加強混凝土(FRC)，則為國內外被廣範研究與應用的一種複合材料。本計畫，是以高性能混凝土為主體構架並摻入適量不同型式之纖維所組成之混凝土材料，它克服了混凝土抗拉強度低、極限延伸率小、脆性等缺點。具有優良的抗拉、抗彎、抗剪、阻裂、耐疲勞、高韌性等性能，並已廣範應用在建築、路橋、水利等工程領域。而這也使得核能廢棄物儲存結構體等重要防護性工程之應用，有了更高的安全性與保障。目前國內對於纖維加強混凝土之應用，已具有相當多的實績，然而對其應用在具放射性環境下的研究卻十分有限。因此，本計畫旨在針對利用新式配比設計觀念，來設計纖維加強混凝土，並觀察其強度、工作性及耐久性等行為。並將各種材料之料源、配比及製作過程，制定其標準作業程序。在針對不同纖維比率，摻入混凝土中進行一連串在不同變數條件下之工作性、強度、韌性、耐久性等實驗。觀察在不同配比情況下，其新拌及硬固性質，並從巨觀及微觀角度，探討纖維加強混凝土應用在低放射性核能廢棄物貯存桶（結構體）之可行性分析。

## Abstract

Nowadays, the new designs (formulations) of concrete with higher standard of material strength, functionality, durability etc. are continuously introduced to meet requirement of different topography, climate and structural shape. As example: The Eugenic Concrete (EC) and High Performance Concrete (HPC) are generally used present days, the Fiber Reinforced Concrete (FRC) also researched and used generally anywhere as compound material. In this proposal, we take HPC as our main component, which we had known that the compound of fiber with different characteristics overcome the problems of insufficient tensile strength, maximum elongation, brittleness etc., means forming compounded concretes with excellent tensile resistance, bending resistance, shears resistance, cracks prevention, fatigue resistance, high toughness etc. The FRC already used commonly in building, road and bridge, water conservancy and other constructions, which also useful in highly protected construction such as nuclear waste storage. At present, the usage of FRC in Taiwan had achieved many good results; however there are lacks of researches about its usage in radioactivity environment. Therefore, the concept of this proposal is aimed on FRC characteristics and new formulation compounding to observe the strength and durability behavior, then designing a standardized material sources, formulations and production processes; continued with a series of experiments with different variable condition of functionality, strength, toughness, durability etc. from different formulation of fiber-concrete compound to observe the characteristic difference of new mixed and hardened compound. At last, we can confer of suitable FRC being used in nuclear waste storage through macroscopic and microscopic view.