

## 中台灣奈米技術科學與工程核心設施計畫---子計畫 III:

### 彰師大部分(I)

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#### 摘要

在此三年的整合型計畫之第一年，我們已如期採購及建立兩件重要的核心設施，而此儀器設備的建立將可以加強及補足彰化師大在奈米製程上的能力。該兩件設施分別是用於深蝕刻矽晶片之電漿耦合活性離子蝕刻機及合成二氧化鈦奈米管之具備紅外線光譜分析之高壓反應爐。前者將在六月中旬由法國原廠技師安裝完成；而後者事實上已於今年二月開放委託使用。如同在總計畫中所定義的分工表，我們彰化師大定位在奈米結構製程的領域。因此在全計畫裡我們提議五件大型核心設施，希望加強及充實我們的製程能力。同時學校當局有感於國科會之支持，在儀器採購過程中，支援了超過一半的設備費（國科會支持六百八十萬，而彰師大配合三百七十萬）。因此，採購程序得以順利，並洽談到最佳的廠牌儀器。雖然電漿耦合活性離子蝕刻機尚未就定位，可是我們在代理商的機房中已做過多次測試，目前得到最佳結構是四十奈直徑且高寬比超過四之矽晶圓柱陣列，相信此結果已證明此技術將在微（奈米）機電領域中扮演一個相當重要的製程角色。

另外，已定位就緒的高壓反應爐已具備合成奈米二氧化鈦管的能力，產量可達克級的合成規模。基於目前的進度及校方的重視和支持，我們相信總計畫在兩年後完成時，我們可已具備成一個國家級的奈米製程中心。

關鍵字：核心設施;電漿耦合活性離子蝕刻機;

高壓反應爐;奈米結構製程

### Abstract

In the first year of this three-year joint project two pieces of core facilities have been purchased and established according to the schedule. These two equipments are inductively coupled plasma reactive ion etcher (ICP RIE) for the deep etching of silicon (Alcatel AMS 100SE) and high pressure reactor equipped with FTIR for the synthesis of TiO<sub>2</sub> tube, respectively. The former will be installed in the mid-June and the latter has been in service since this February already. As was defined in the joint project, the mission at National Changhua University of Education (NCUE) is focused on the nanofabrication process, in which five pieces of core facilities were proposed to enhance and compensate the fabrication capability of what have existed at NCUE. In order to facilitate and speed up the whole process, a matching fund for over 50 % of the funded budget was put into this project, namely extra 3.7 million NTD from our university (NCUE) was added on the top of the 6.8 million NTD funded from NSC. The ICP RIE has been tested at the vender site and the best structure achieved is 40 nm diameters of silicon pillar arrays having height to diameter ratio of 4 to 10. It is believed that this key process may play an important role in the fields of MEMS and NEMS. In addition, by using the high pressure reactor equipped with FTIR pure TiO<sub>2</sub> nanotubes have been prepared in grams quantity by treating the TiO<sub>2</sub> anatase powder with concentrated NaOH solution at elevated temperature. Based

on the progress we have made so far, we believe that a national level of nanofabrication facilities can be established in two more years.

Key words: Core facilities;

Inductively coupled plasma reactive ion etcher;

High pressure reactor;

Nanofabrication