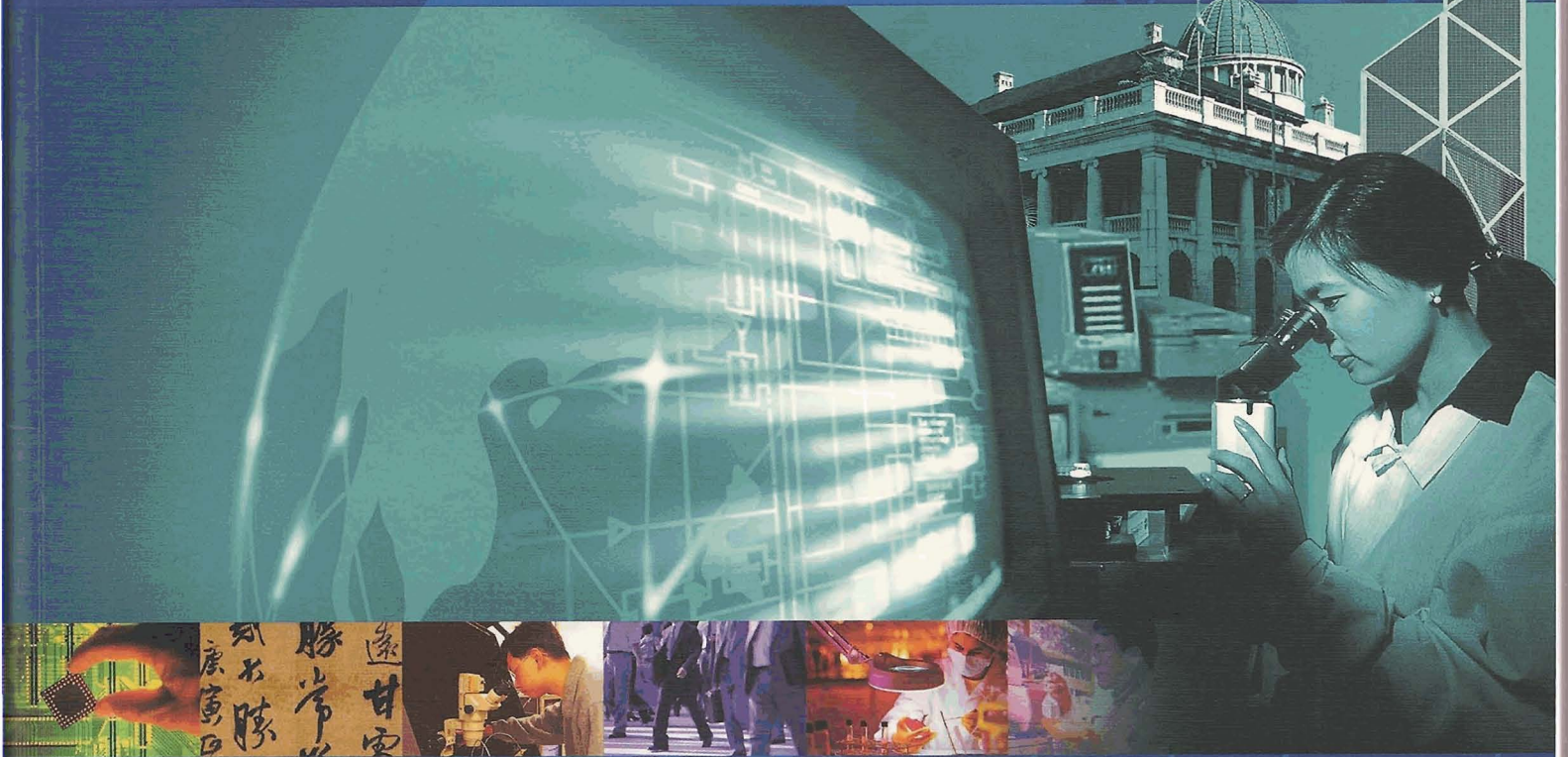


RESEARCH GRANTS COUNCIL  
OF HONG KONG, CHINA



Annual Report 1998

# Fabrication of the Thin Separation by Implantation of Oxygen (SIMOX) by Plasma Immersion Ion Implantation (PIII)

## Summary

This silicon-on-insulator wafer technology, co-developed in Hong Kong and adopted by Silicon Valley, represents the next generation in electronic chips. Cheaper and smarter computers and appliances are just around the corner.

## Reference

CityU 1034/96E

## Institution

City University of Hong Kong

## RGC Grant Awarded

\$1,208,000

## Duration

1996-1998

## Principal Investigator

Professor Paul K. Chu

## Objective

To devise a process that can economically produce high quality silicon-on-insulator (SOI) wafers for next generation electronic chips.

## Background

During the creation of the Plasma Immersion Ion Implantation (PIII) technology by Professor Chu's team in the early 1990s, many ideas were generated as to possible applications.

The timing to pursue an SOI application coincided with the opportunity to become the forerunner in producing a more economical way to build SOI wafers. This step ultimately enables more consumers to enjoy access to the benefits of the "electronic age" through reducing the cost of materials and equipment.

## Results

Although Professor Chu held several assumptions over how the results would transpire, the ultimate discovery exceeded all expectations. The first full SOI wafer of its kind in the world was produced in early 1998.

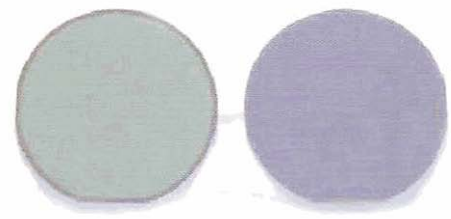
The project demonstrated that SOI can be fabricated using PIII, which features many benefits over traditionally prepared SOI wafers used in low-power, high-speed microelectronics.

With several patents now pending on this technology, the discovery has reaped much commercial success. Professor Chu and his team received an industrial contract with a Silicon Valley (USA) company to commercialise the PIII process for SOI production.

Academically, several project assistants received their PhDs, and many articles and conference papers have been published. This work was also chosen to represent Hong Kong and featured on the cover of the May 1997 special 40th year anniversary issue of *Solid State Technology*, one of the top trade journals published in the US and read by engineers, managers, and academics in the semiconductor world.

Professor Chu is currently working on the fundamental side of further research to build a bridge to industrial application. Collaborative projects so far have included application to aeronautical and medical fields, and general materials for critical components such as improving the life span of oil pumps.

None of these results would have been possible had it not been for the Research Grants Council's continuing support, particularly their funding of the first project which led to the creation of PIII technology.



SOI wafer

Donor wafer

1

The new SOI wafers are only possible thanks to the early work by Professor Chu

2

A first of its kind a SOI wafer.

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# 用新 PIII 技術製造 薄 SIMOX 片

## 摘要

在香港開發、為美國矽谷採納使用的絕緣體上硅薄片生產技術，為我們帶來下一代電子晶片。更經濟、更高智慧的電腦和電子用品即將出現。

參考編號 CityU 1034/96E

參與院校 香港城市大學

研資局資助金額 \$1,208,000

項目年期 1996-1998

首席研究人員 朱劍豪教授

## 研究目的

設計一種經濟的生產過程，以製備用於下一代電子晶片的優質絕緣體上硅 (SOI) 薄片。

## 背景資料

朱劍豪教授的研究小組於九〇年代初，拓展等離子浸沒離子注入 (PIII) 技術時，已有人對這項技術在應用上的可能性提出不少意見。

應用在 SOI 上的研究可說來得合時，因為當時對低成本生產 SOI 薄片正有所需求，而研究小組便成為了這方面的先驅。由於生產成本降低，致令更多消費者可分享到「電子時代」所帶來的種種好處。

## 成果

雖然朱教授對這項研究會有甚麼結果作出過多種假設，但最後的發現卻出乎意料之外——世界上首片利用 PIII 技術製造的 SOI 薄片成功製成！

這項研究證明了採用 PIII 技術可製造 SOI，其特性比一般用於低電源高速微電子裝置的硅薄片更勝一籌。

這新發現帶來重大的商業成就，有關技術現正申請專利註冊。朱教授及其研究小組與美國矽谷一間公司已簽訂了合約，把 PIII 技術商業化以生產 SOI。

學術方面，共有多位研究生因此而獲頒哲學博士學位。此外，有關的文章和會議論文亦發表了不少。此研究項目更被選出刊登於一九

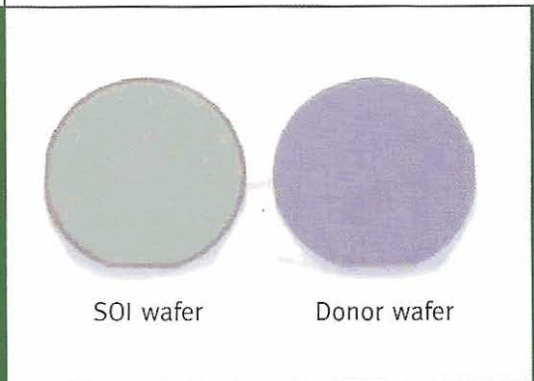
九七年五月出版的 Solid State Technology 四十週年特刊中，作為香港的代表作品。

朱教授現正在基礎研究上進一步鑽研，務求取得與工業應用的銜接。合作項目包括在航天科技及醫學上的應用，以及製造重要元件（如延長油泵壽命的元件）之原料等。

假如沒有研資局長期以來的資助，尤其是批予第一個令 PIII 技術得以面世的研究撥款，就不會有以上的成果。



1



2

1 全賴朱教授早期對 PIII 技術的研究，新的 SOI 薄片得以研製而成。

2 世界上首片 SOI 薄片。

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