

# 大面積RTP硒硫化製程技術暨設備自主開發計畫

執行單位

國家中山科學研究院飛彈火箭研究所

計畫主持人

吳典勳

- CIGS製程多樣，材料、製程、設備相互關聯，其中濺鍍銅、銮、鎳後再硒化/硫化之大面積量產技術由於有較佳之材料特性與轉換效率，是現階段各國發展CIGS薄膜電池之產業化之主流技術。為能配合產業發展脈動並掌握CIGS太陽電池關鍵技術，以及目前國內業界以前驅物-硒化法（Selenization of precursor materials）為主流之CIGS製程，本計畫遂進行法人與業界之分工與垂直整合，建構CIGS太陽電池製程技術與自主設備，以提昇國內太陽能產業之競爭力。
- 本計畫配合業界二階段快速硒化之需求，投入建立自主化之大面積RTP硒化/硫化製程設備開發，未來可以搭配推升相關CIGS電池低成本及高產能之商品化競爭力。開發大面積快速熱處理硒化/硫化技術、大面積熱均勻技術、線性大氣電漿裂解硒/硫化製程及設備技術、硒/硫氣氛腔體CIGS化合及腐蝕防治技術、溫度分佈參數製程及其精密控制技術、玻璃基板及其薄膜熱應力分析及製程參數調控技術，以提升國內設備業暨太陽能產業競爭力。

## 申請專利

- 熱滾輪與基板熱影響分析及設計
- 快速加熱腔體與硒硫化腔體之製程與設備之整合設計
- 大氣線性電漿裂解硒或硫之硒化硫化製程及製程設備技術
- 大面積基板薄膜快速熱處理及邊界熱補償設計



## 計畫簡介

- 配合業界二階段快速硒化之需求，投入建立自主化之大面積RTP硒化/硫化製程設備開發
- 開發大面積快速熱處理硒化/硫化技術、大面積熱均勻技術、硒/硫氣氛腔體CIGS化合及腐蝕防治技術、溫度分佈參數製程及其精密控制技術、玻璃基板及其薄膜熱應力分析及製程參數調控技術

## 核心技術

- 利用RTP加熱及以線性大氣電漿快速硒化CIGS薄層以取代高溫爐毒性硒化，滾輪中空並置入加熱燈組形成熱滾輪以均勻滾輪與基板接觸之熱應力。混合高溫硒或硫蒸氣以及運載惰性氣體於大面積之玻璃基板上均勻分佈，穩定之層流模式連續均勻的分佈於反復運動之玻璃基板上。

# The development of Rapid Thermal Process and Apparatus on Selenization / Sulfurization technology for Large Scale solar cells

Execution Unit

National Chung-Shan Institute of Science & Technology

Project Director

Wu, Ten-Fu

- The present project relates to develop an apparatus and process for making an absorbing layer of a CIGS solar cell and, more particularly, to establish the capability of technology on domestics for a Rapid Thermal Process & apparatus technology on Selenization / Sulfurization method for Large Scale solar cells. To accommodate the trend of the low cost mass production of the solar cell, the development of the process & apparatus for making solar cell will be obtained such as the unique and key technologies about uniform heating method on large scale substrate and uniform dispersing selenium/sulfur gas are surveyed and developing in the field of Rapid Selenization / Sulfurization technology. The apparatus includes a transportation unit, a crack selenium/sulfur generator unit(including linear plasma source), a heat treatment unit, a measurement unit and a control unit. The transportation unit transports a substrate-based laminate will be integrated with the heating unit.

- SELENIZATION/SULFURIZATION PROCESS APPARATUS FOR USE WITH SINGLE-PIECE GLASS SUBSTRATE
- HIGH-TEMPERATURE GAS PRESSURE MEASURING METHOD FIELD OF TECHNOLOGY
- A UNIFORM LINEAR PLASMA DISTRIBUTED APPARATUS



## Project Introduction

The present project relates to develop an apparatus and process for making an absorbing layer of a CIGS solar cell and, more particularly, to establish the capability of technology on domestics for a Rapid Thermal Process & apparatus technology on Selenization / Sulfurization method for Large Scale solar cells.

It is an objective of the present invention to provide a selenization / sulfurization process apparatus capable of heating a single-piece glass substrate uniformly and performing selenization / sulfurization thereon uniformly. Another objective of the present invention is to provide a selenization /sulfurization process apparatus for replacing selenization or sulfurization of toxic  $H_2Se$  or  $H_2S$  in a vacuum environment with cracking selenium or mixing sulfur with an inert gas in a near-atmospheric pressure environment. A linear plasma is generated in the plasma generating space, and the generated plasma flows out through the slit opening a sleeve having a plurality of holes that are distributed according to CFD(Computational Fluid Dynamics) analysis , that (the linear plasma)can cracking selenium to react with CIG film to obtain CIGS film.