

用於矽晶異質接面太陽電池的關鍵製程研發設備開發計畫

執行單位

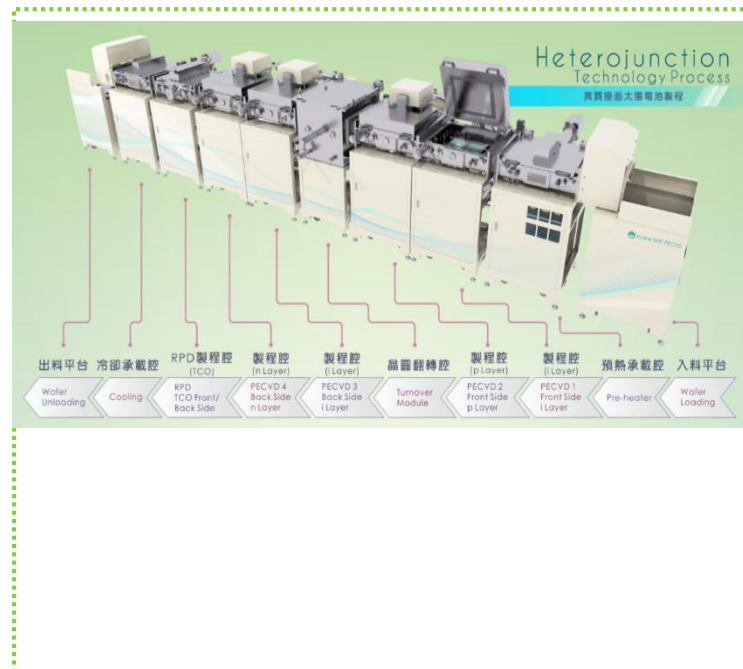
財團法人金屬工業研究發展中心

計畫主持人

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金屬中心開發高效能HIT太陽電池的關鍵製程設備，其為一超高頻(40.68MHz)連續式電漿鍍膜設備，全機七成以上自主設計，並完成百分之百自主評估與系統整合。本研發型設備首創搭載晶圓翻轉腔設計，具全程真空製程環境設計，可降低環境水氣與污染物直接和製程腔體接觸的風險，增加製程穩定度與生產速度。本研發型設備其HIT太陽電池年產能預計為525KW，未來設備可擴充成單次生產64片晶圓，年產能將可達10 MW。

1. 國內專利申請：太陽能電池結構及其製造方法、一種具即時回饋控制之基板薄膜均勻性調變系統、電漿沉積裝置及薄膜沉積方法、電漿鍍膜系統、化學拋光劑及使用其的太陽能電池的晶圓前處理方法、「多晶矽層的製造方法、異質接面太陽能電池及其製造方法」、矽基疊層的形成方法及矽基異質接面太陽能電池的製造方法
2. 國外專利申請：太陽能電池結構及其製造方法、矽基異質接面太陽能電池、SOLAR CELL STRUCTURE AND METHOD FOR MANUFACTURING THE SAME



● 成果與亮點

1. 設計研發型40.68MHz In-Line PECVD設備機構，整合六大系統(氣體供應系統、射頻系統、真空系統、溫控系統、傳輸系統及控制系統)，達成70%以上自主設計，並完成100%自主評估與系統整合。
2. 開發矽晶異質接面太陽電池之多項關鍵製程技術，包含本質層矽薄膜製造技術、元件結構光電特性模擬運算技術、低溫銀漿電極技術晶圓低反射率形貌蝕刻製程技術、IPA-Free低汙染添加劑晶圓蝕刻製程技術及上述製程結果之量測及驗證技術。
3. 整合法人、設備商及電池生產商之量能，將可快速佈局相關多能隙接面技術之設備及製程專利，未來將推動國內設備業者導入國產供應鏈設備，協助本土廠商提升零組件與模組開發能力，結合國內終端太陽電池產品製造廠量能，進行量產化設備製程驗證測試。

Development of Key Processing Research Equipments Used for Heterojunction Silicon Solar Cells

Execution Unit

Metal Industries Research & Development Centre

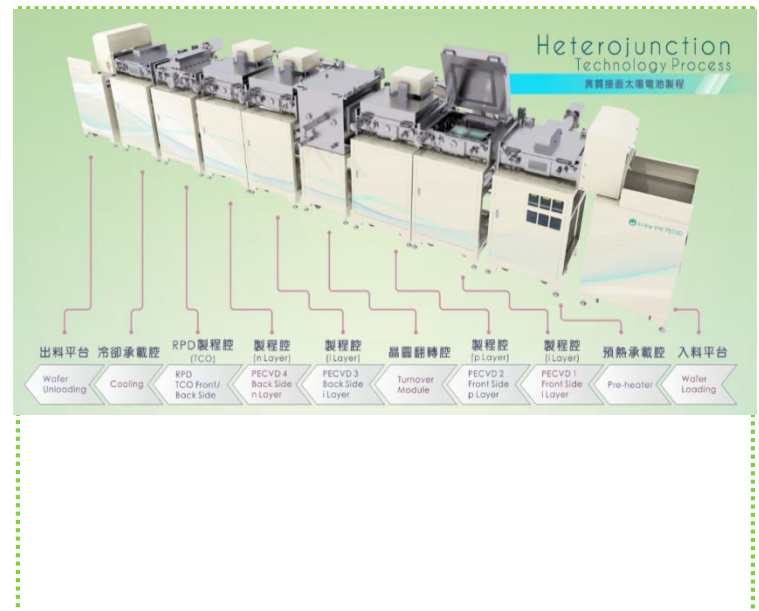
Project Director

Dr. Yii-Der Wu

MIRDC develops a key process apparatus for HIT Solar Cell, 40.68MHz In-Line VHF PECVD, which is self-designed over 70% and fully self-assembled and integrated by MIRDC. The apparatus can be fully used for vacuum process, improving the quality of a-Si films, increasing the process stability and production rate. The capacity of this laboratory scale apparatus is assessed to the goal of 525KW per year and modular design is utilized for this apparatus.

The production capabilities will achieve 10 MW per year by improving the module apparatus design with expanding the yield to 64 wafers/run.

1. Domestic patent application: "Solar cell structure and manufacturing method thereof", "A substrate film uniformity modulation system with instant feedback control", "Plasma deposition equipment and film deposition method", "Plasma coating system, chemical polishing agent and solar cell using the same wafer pretreatment method", "Method of producing polycrystalline silicon layer", "Heterojunction solar cell and method of manufacturing the same", "Method of forming a silicon-based laminate, and method of manufacturing a silicon-based heterojunction solar cell".
2. Foreign patent application: "Solar cell structure and its manufacturing method", "silicon-based heterojunction solar cell".



Achievements and highlights

1. We design and develop 40.68MHz In-Line PECVD equipment organization, and integrate six systems (gas supply system, RF system, vacuum system, temperature control system, transmission system and control system) to achieve more than 70% independent design and complete 100% autonomy evaluation and system integration.
2. We develop a number of key process for silicon heterojunction solar cell technologies, including the intrinsic silicon thin film manufacturing technology, the analog computing technology for optoelectronic characteristics of the cell structure, low temperature silver paste electrode technology, wafer etching process technology for low-reflectivity topography, IPA-Free wafer etching process technology with low contamination additive, and the measurement and verification for the aforementioned process results.
3. Integration of the power among MIRDC, equipment manufacturers and battery producers will enable the rapid deployment of equipment and process patents related to multi-gap junction cell technology. In the future, domestic equipment manufacturers will be encouraged to import domestic supply chain equipment to assist local manufacturers in upgrading their components and cell modules development capabilities, and the manufacturing capacity from domestic terminal solar cell would be combined to validate the mass production equipment process.