

# 太陽能光熱波段分離之複合發電創新模組技術研究創新前瞻計畫

執行單位

財團法人金屬工業研究發展中心

計畫主持人

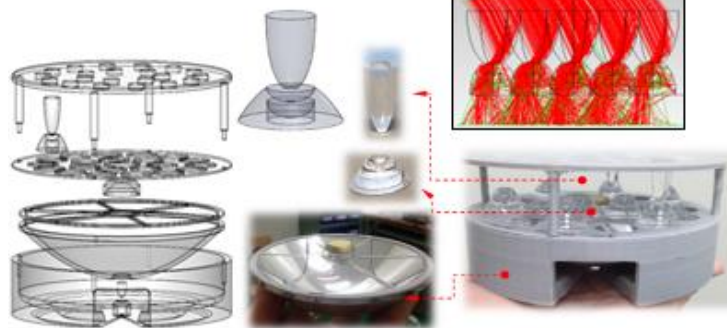
劉文鈞

- 所研發太陽能光熱波段分離之複合發電創新技術，因不須追日機電驅動裝置即可具有廣角收光效果，可與追日型太陽能具同等太陽光利用效率提昇功效，且尚可藉光熱波段分離解決一般太陽能電池模組因過熱使轉換效率嚴重遞減的問題，由此產生高效率的全光譜太陽能複合光熱發電。

申請專利：

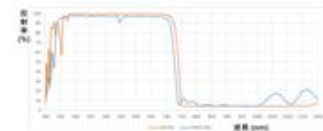
1. 集光模組(TW)
2. 遮陽裝置(TW)
3. 應用於迴路熱管之散熱裝置及其殼體之製造方法(TW)

雙反射式高聚光型  
太陽光能導引模組



多層膜光熱波段  
分離模組

Wavelength (nm)	Refractive Index	Extinction Coefficient
428.99	2.63963	0.00203
472.92	2.5462	0.00125
540.98	2.4955	0.00032
629.15	2.41955	0.00008
772.96	2.37808	0.00048



熱管型熱導引  
模組



## ● 技術介紹：

- ◆ 雙反射式高聚光型太陽光能導引模組，具備光通量均化元件(光接收面)：平均照度~500-1,000 kW/m<sup>2</sup>，提高出光照度與均勻性；及偏射光準直化次模組套件設計：可允許仰角/方位角變化 > ±30度；光半強角 < 4度，提升日照偏射集光穩定性。
- ◆ 多層膜光熱波段分離模組，提供客製波段選擇之光熱分離功效，設計案例光譜特性為780nm以上波段平均穿透率>85%，而在360~780nm波段平均反射率>95%。
- ◆ 熱管型熱導引模組，提供中溫型熱發電整合導引所需熱能集中結構，完成專利分析、熱場模擬與設計分析、銅/不銹鋼複合材料製程開發。

## ● 目前發展情形：

- ◆ 完成太陽能光熱波段分離技術之雙反射式高聚光型太陽光能導引模組與多層膜光熱波段分離模組雛型試製。
- ◆ 驗證雛型模組之廣角收光高聚光與光能波段分離特性。
- ◆ 近期將推動於實際太陽能發電試驗場域之整合測試。

# Project of the Innovative Hybrid Solar Power Generation Module Technology

Execution Unit

Metal Industries Research & Development Centre

Project Director

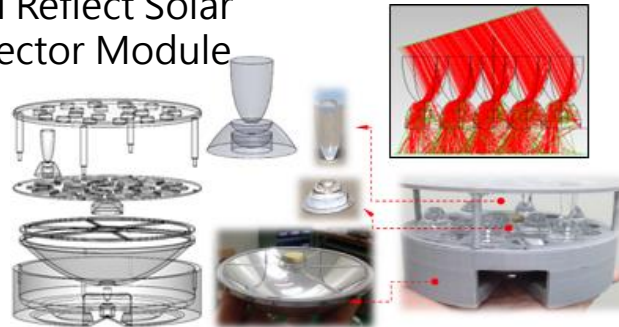
Wen-Jiun Liu

- The “Innovative Hybrid Solar Power Generation Module Technology” , could receive wide-angle sunlight as like the solar tracking system but without using mechatronic device. The developed optical mechanism could provide solar spectrum splitting by a customized cold mirror module to achieve hybrid PV and TE power generation.

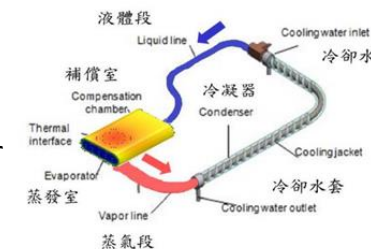
Patent Application :

1. Solar Collector Module (TW)
2. Sunlight Shading Device (TW)
3. Fabrication method of the loop heat pipe heat transfer device (TW)

Dual Reflect Solar Collector Module



Heat Pipe based Thermal Transfer Module



Multi-Layer Solar Spectrum Split Module

Wavelength (nm)	Refractive Index	Extinction Coefficient
428.99	2.63963	0.00203
472.92	2.5462	0.00125
540.98	2.49655	0.00032
629.15	2.41955	0.00008
772.96	2.37808	0.00048



## ● Technology Brief :

- ◆ Dual Reflect Solar Collector, used for efficiently collecting solar power without mechanical solar tracking, could achieves uniform light irradiance distribution on the CPC exit aperture with mean irradiance 500-1,000 kW/m<sup>2</sup> , and light guiding with ultra-wide view optical efficiency above 80% within misalignment angle  $\pm 30$  degree.
- ◆ Solar Spectrum Split Module, provides customized spectrum split by multi-layer dielectric coating, e.g. transmits 85% of selected spectrum (360~780nm) while reflecting over 95% of others (above 780nm).
- ◆ Heat Pipe based Thermal Transfer Module, loop heat pipe structure used for medium temperature thermal electric, with patent analysis, thermal CAE analyses, and Copper-Stainless dual materials compound forming method development.

## ● Achievement :

- ◆ Establish prototypes of dual reflect solar collector module and multi-layer solar spectrum split module.
- ◆ Prototype Validation for the solar concentration and spectrum split functions.
- ◆ Collaborate with the PV power plant field for long term technology application test in the near future.