

# 國家奈米元件實驗室

## CIGS製程技術服務介紹

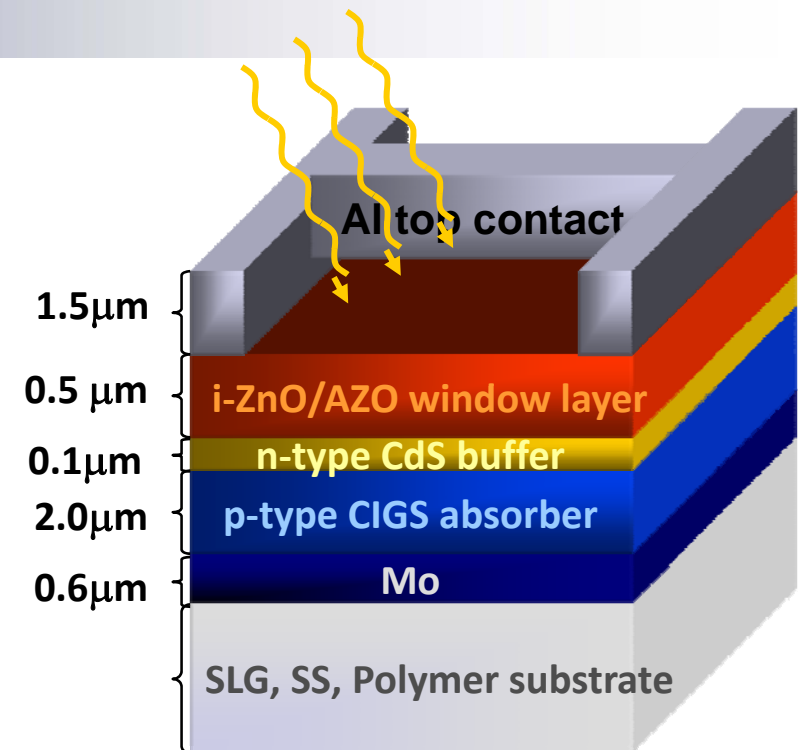
### Contact Window

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# Introduction of CIGS solar cell

- High efficiency
  - ZSW (Germany) verified cells as high as 20.3%
- Low cost (in volume)
  - Process costs are lower
  - Manufacturing costs are lower
- Low thermal budget process
  - Flexible; portable; building integrated photovoltaic (BIPV).



# Green CIGS Solar Cells

## Cd-free and non-toxic selenization

	a-Si	CdTe	CIGS
Cell Efficiency	15% Triple junction	<b>16.7%</b>	<b>20.3%</b> <b>(ZSW)</b>
Module Efficiency	8% (Kaneka)	10.8% (First Solar)	15.22% (Showa)
Cost(1 GWp)	US\$0.67/Wp	US\$0.47/Wp	US\$0.53 /Wp

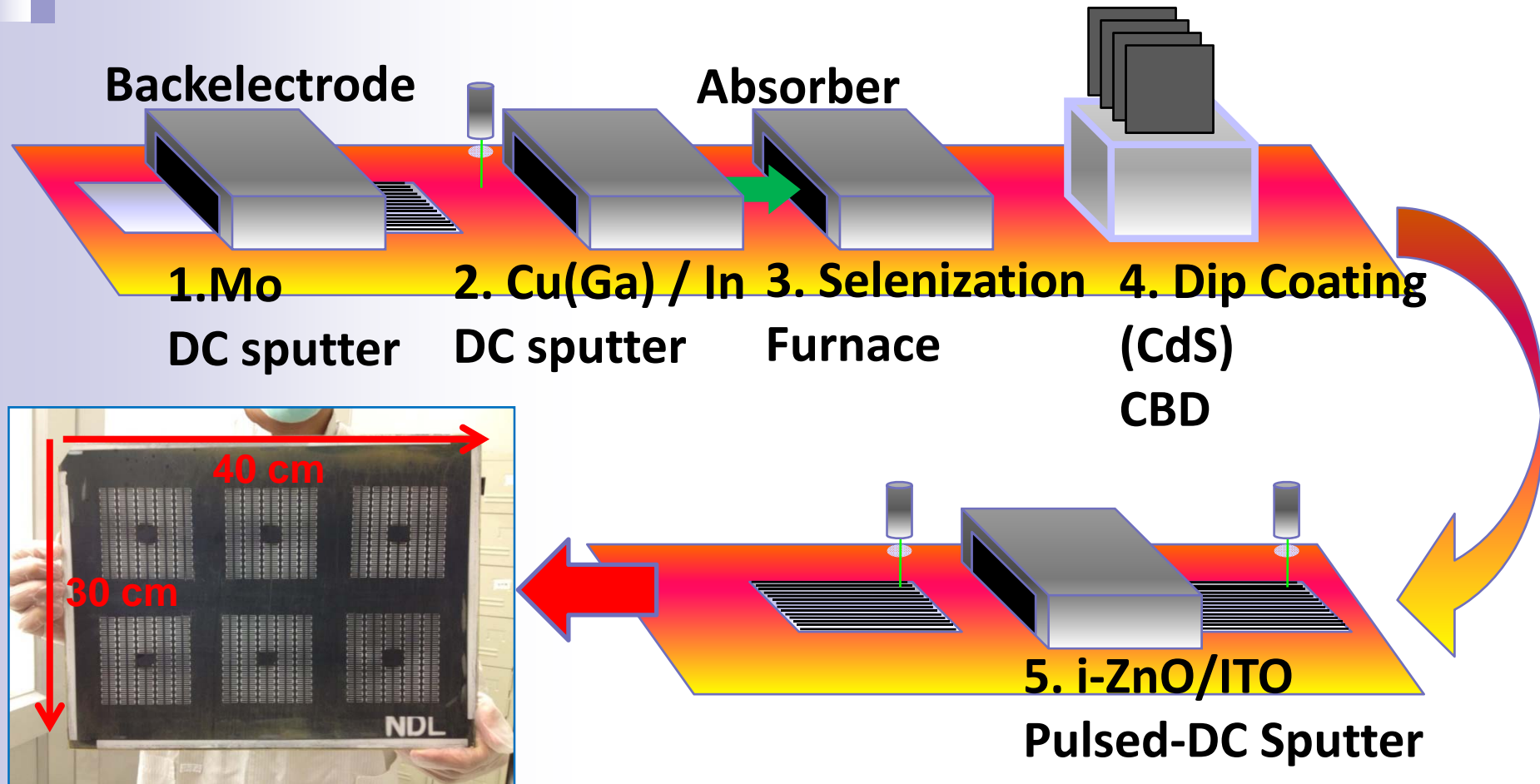


**Metal, TCO, CIG  
Sputter**



**H<sub>2</sub> plasma Selenization  
Plasma furnace**

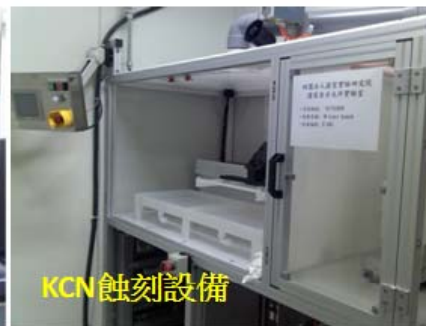
# NDL CI(G)S Solar Cell Platform(新竹)



Size: G1(30X40cm<sup>2</sup>)

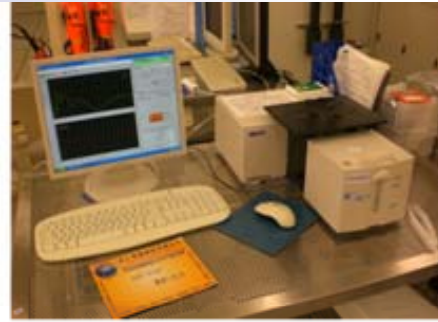


# NDL CIGS Process Facility (新竹)

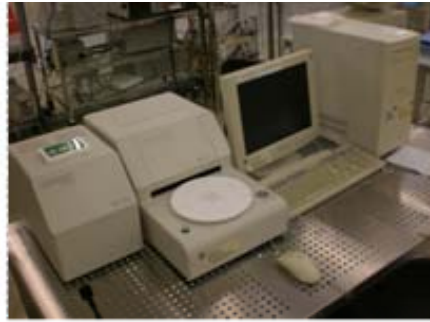


- 連續性濺鍍設備主要以Mo、CuGa、In、ITO、ZnO、Al等材料製程為主，目前靶材裝設已滿，並不提供其他材料靶材之使用，且無提供鋅錫等靶材之製程研究。但可協助CZTS solar cell後段製程。
- 硒化設備為無毒氫電漿硒化設備，製程過程無 $H_2Se$ 劇毒氣體，但為安全考量，於周遭環境裝設 $H_2$  and  $H_2Se$ 氣體偵測器及相關廢氣處理系統。

# NDL G1(30X40cm<sup>2</sup>) CIGS Analysis Tool (新竹)



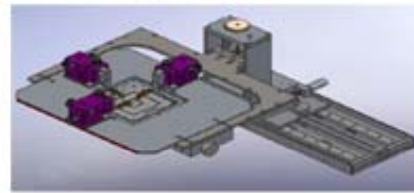
**N&K-薄膜測厚儀**  
量測TCO和p-i-n薄膜厚度、消光系數和反射率



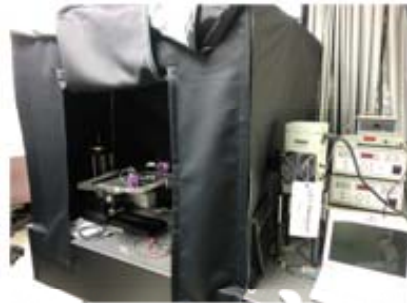
**Metal 4 point probe-金屬膜四點探針量測儀**  
量測TCO和p-i-n薄膜片電阻



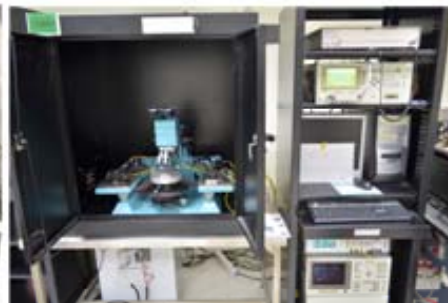
**UV-vis-紫外-可見光光譜儀**  
量測TCO和p-i-n可見光穿透率



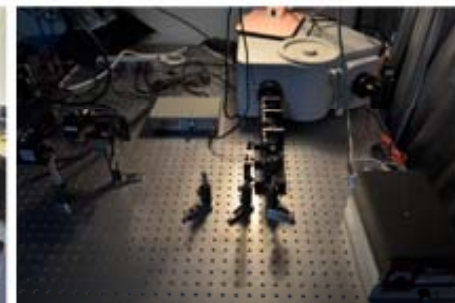
**Solar simulator-太陽光模擬器**  
模擬AM1.5g 太陽光譜量測太陽能電池轉換效率



**Bias QE-量子效率量測**  
量測太陽能電池對不同波長光線之轉換效率

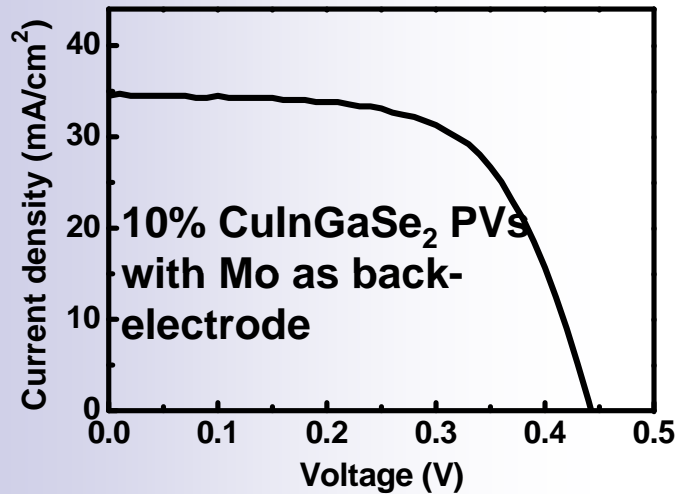
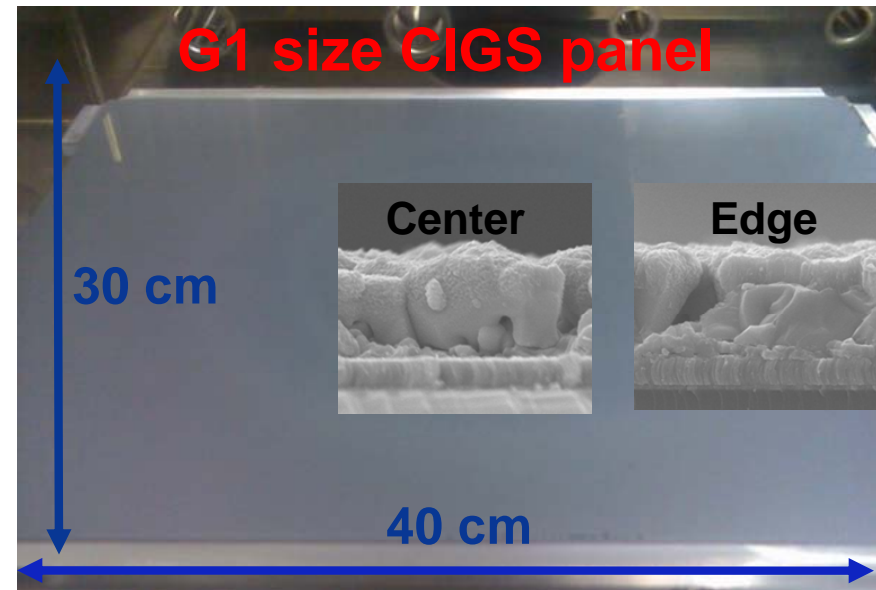
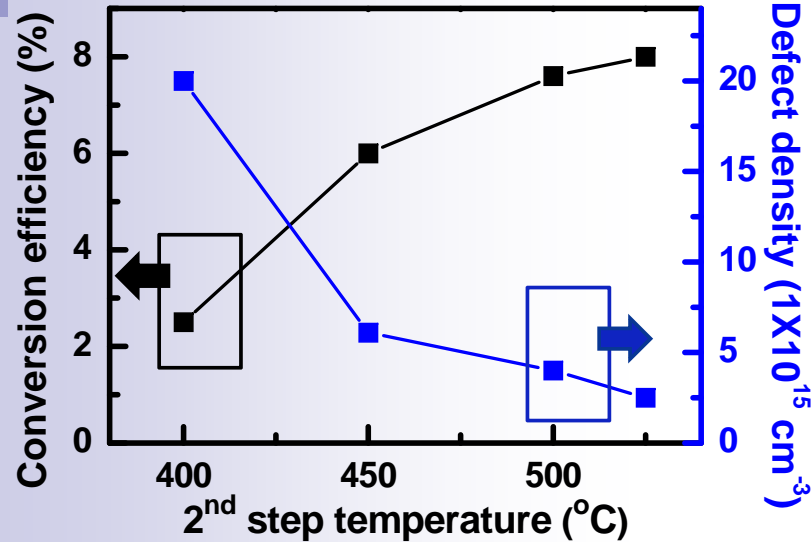


**DLCP-驅動位準電容特性曲線**  
不同缺陷之分佈



**PL-光致螢光光譜**  
量測缺陷能量及薄膜能隙

# Fabrication of 525°C CIGS Solar-electricity



- Low-defect CIGS films.
- 10% conversion efficiency.
- Good uniformity on G1 size panel.

# Quotation

ITEM	Unit Price	Area (cm <sup>2</sup> )
Mo/SLG	1000	10x10
CIG Precursor	3000	10x10
Selenization	4000	10x10
KCN Etching	2000	10x10
CdS Deposition	2000	10x10
TCO	2500	10x10
NDL濺鍍/後硒化CIGS solar cell based line，轉換效率8%。		
Co-Evap. CIGS	15000 (9pcs)	2x2
共蒸鍍製程為小面積樣品，只接受批次(9片)申請單。效率可達10%		

- **服務模式：**
- **NDL 對外服務系統/MES 系統 - 10% cash. 可單站代工。**
- **自行操作：**開放以下兩組設備由博士班學生操作，每周固定開放一個時段。**(a)**小面積硒(硫)化氬氮退火爐.**(b)**小面積化學水浴沉積設備 - **CdS buffer layer.**