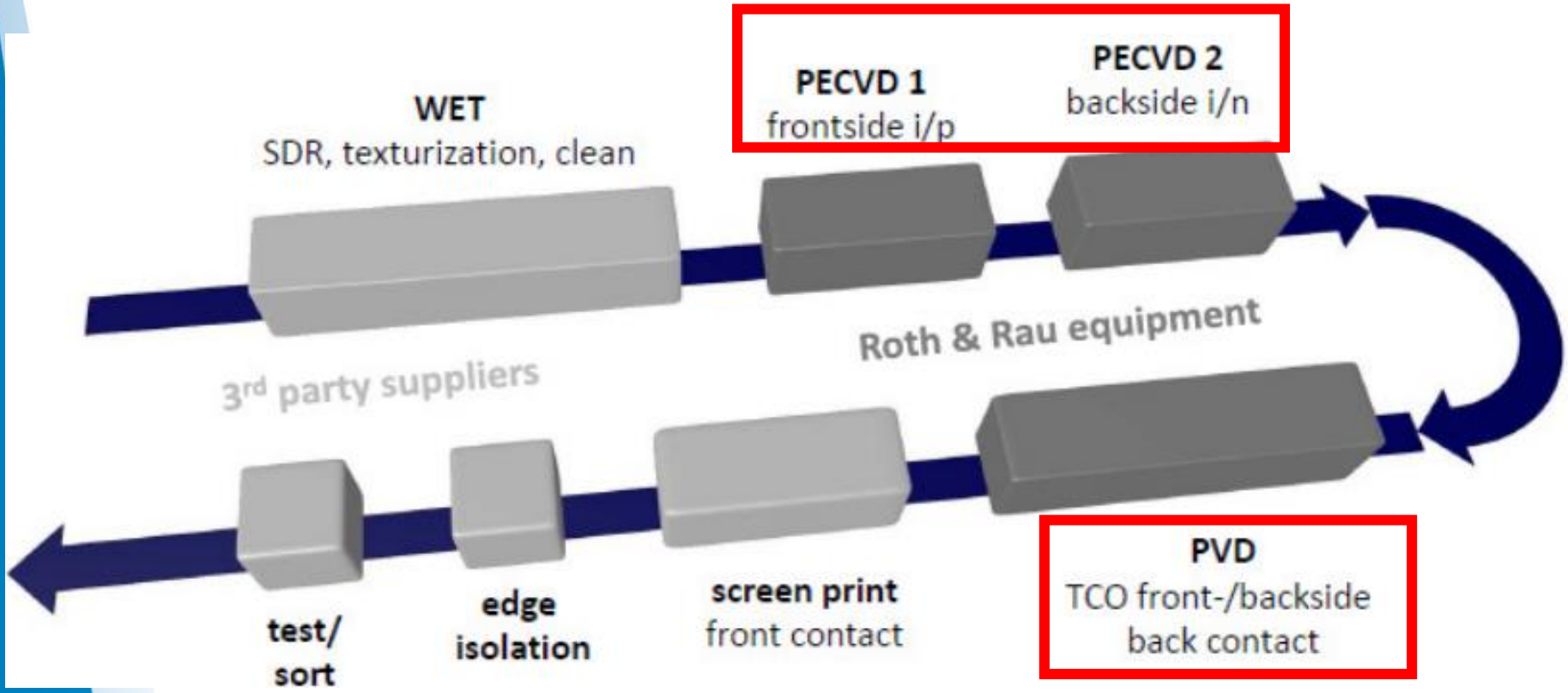
金屬工業研究發展中心
METAL INDUSTRIES RESEARCH & DEVELOPMENT CENTRE

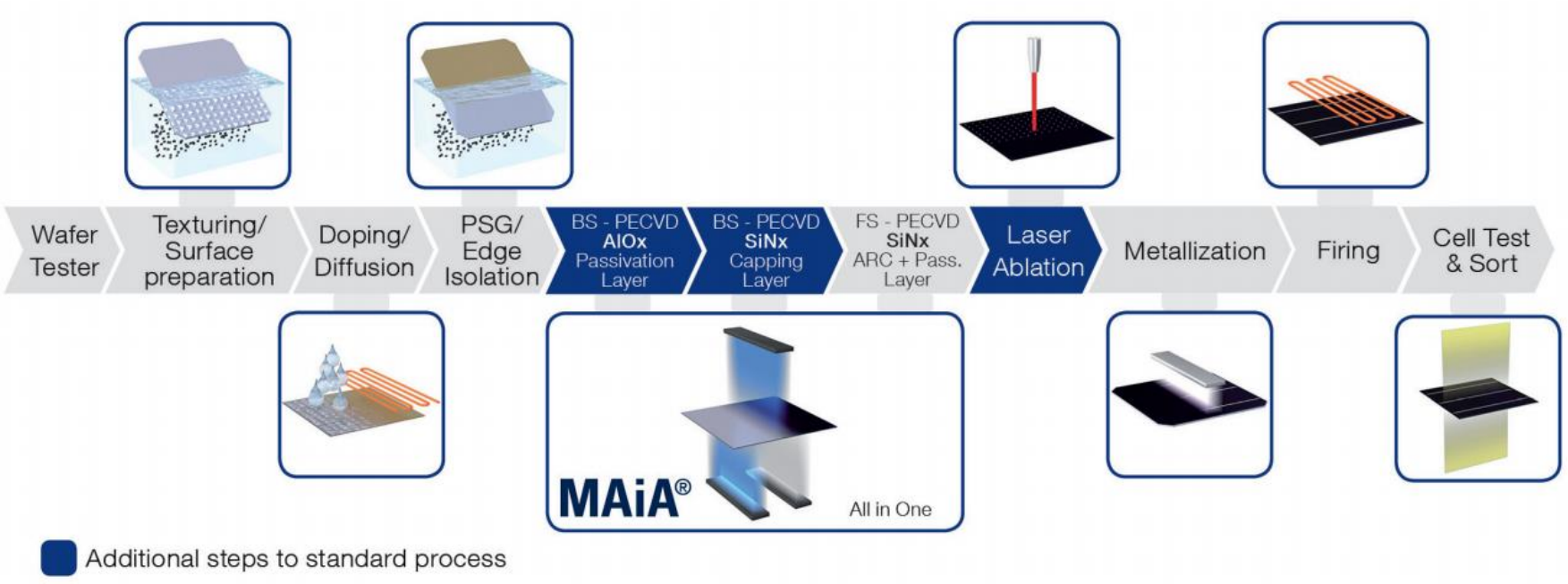
太陽電池鍍膜設備概要

HIT太陽能電池製程產線



Source:Roth&Rau

PERC 太陽能電池製程產線

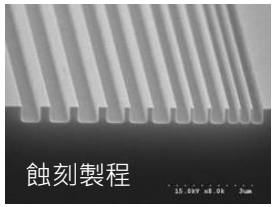


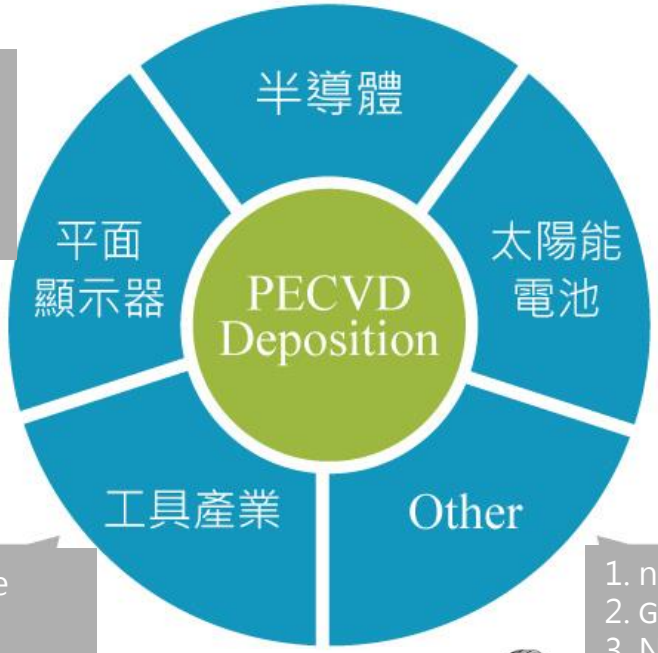
Source:Roth&Rau

電漿化學氣相沉積設備(PECVD)- industry application

1. barrier layer
2. Si thin film
3. Antireflection film
4. Protecting film

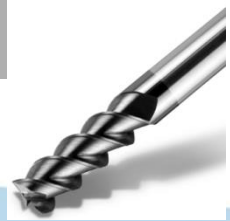
1. Etching process
2. Microelectronics material
3. isolation film
4. Barrier film

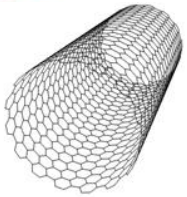




1. Amorphous
2. Single & poly crystal
3. HIT

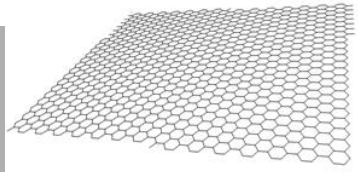
1. Diamond-like carbon
2. optics film
3. Surface Modification





奈米碳管

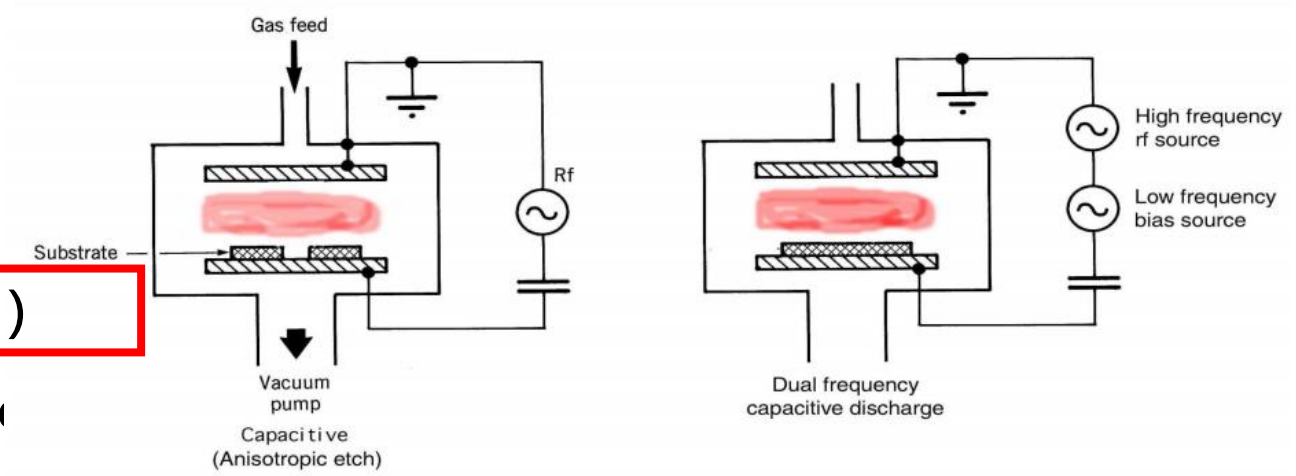
1. nanotube
2. Graphene
3. Nano film
4. Organic film
5. Chemical sensor



石墨烯

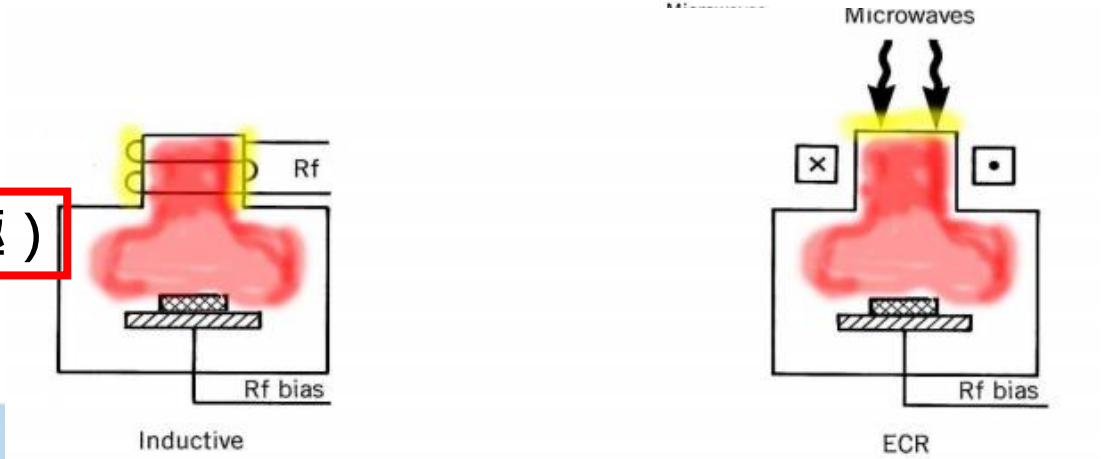
電漿化學氣相沈積-（Plasma enhance CVD, PECVD ）

- PECVD包含二種主架構:
- (1)CCP (capacitive coupled plasma)



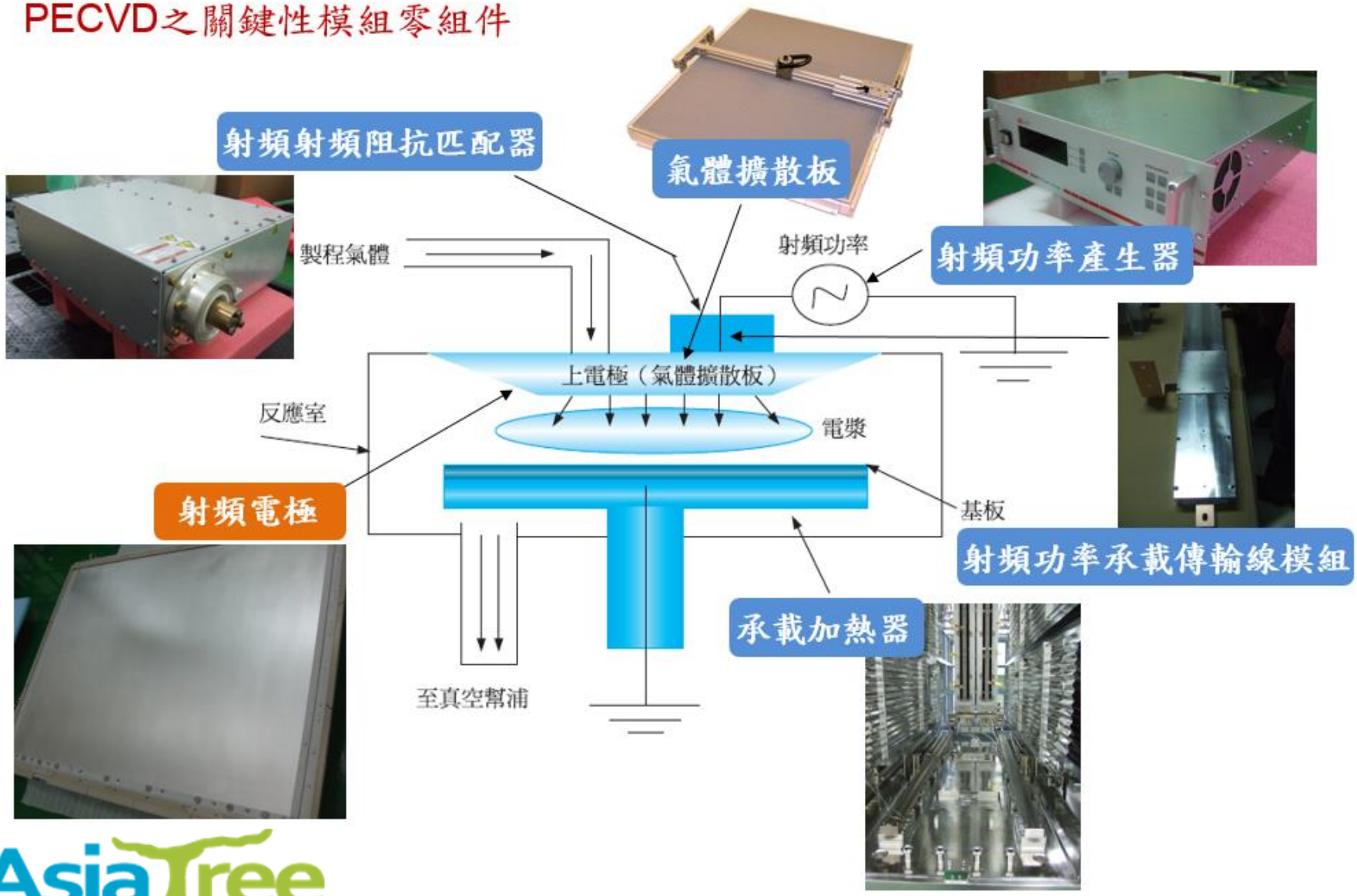
電容式結構（雙平板）

- (2)ICP (Inductiv



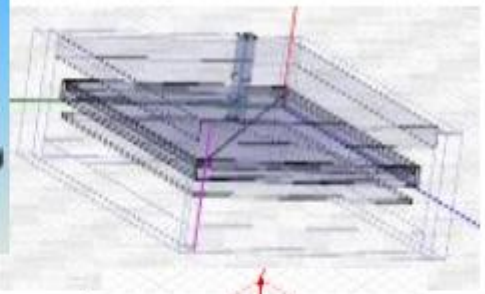
電感式結構（螺旋電感電極）

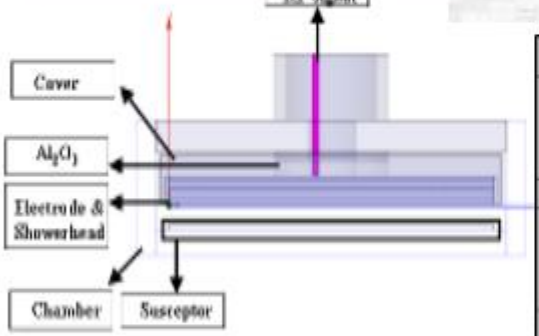
Key components of PECVD

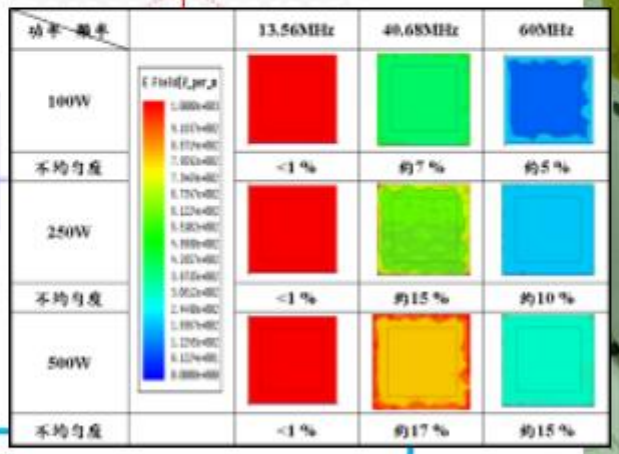


PECVD設備實機

- 金屬工業研究發展中心，開發具13.56 MHz至60MHz的電漿源PECVD。
- 實機經驗中成功以VHF 60 MHz生產氫化微晶矽（ μc -Si ）薄膜。







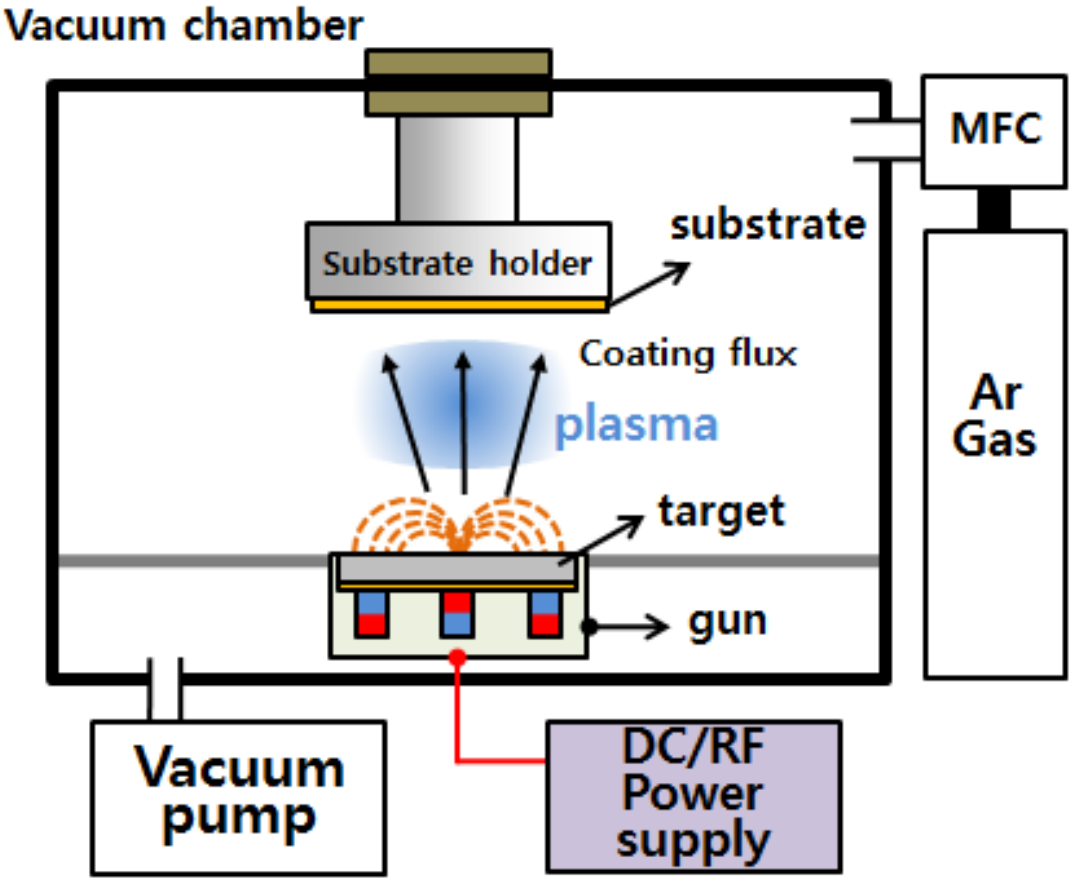
微晶矽鍍膜成品

規格簡介

- 頻率：HF (13.56 MHz)~VHF(40.68, 60, 81 MHz)
- 功率大小: ~ 2 KW
- 基板尺寸：< 30 cm x 30 cm
- 客戶實機經驗(1)氫化非晶矽膜(2)氫化微晶矽膜

物理氣相沈積-濺鍍 (sputter)

濺鍍為一種相當成熟的技術，為常見的量產製程設備。

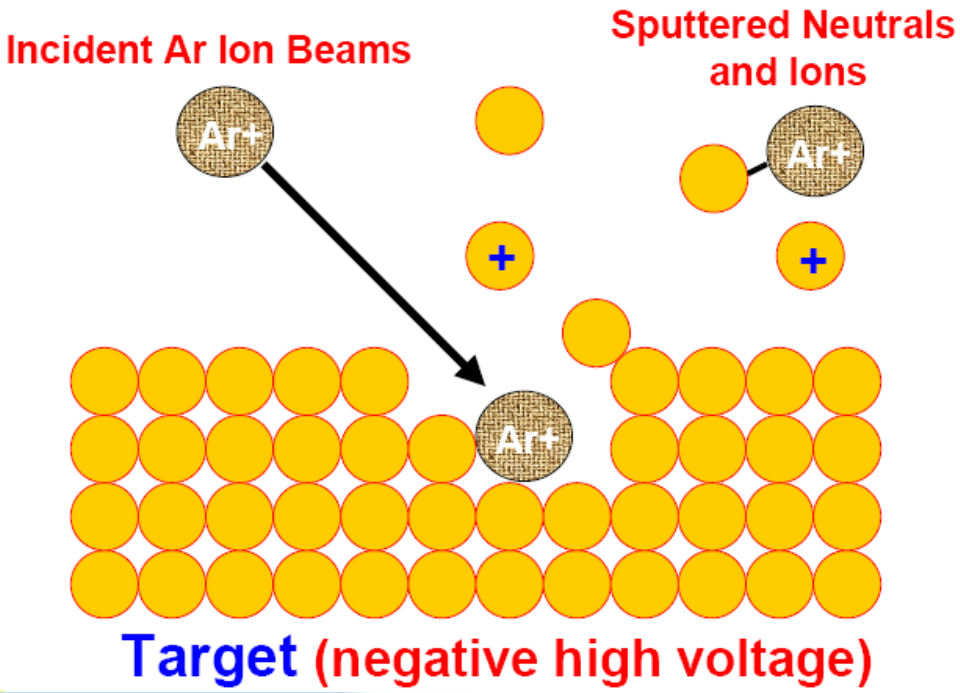


物理氣相沈積-濺鍍 (sputter)原理

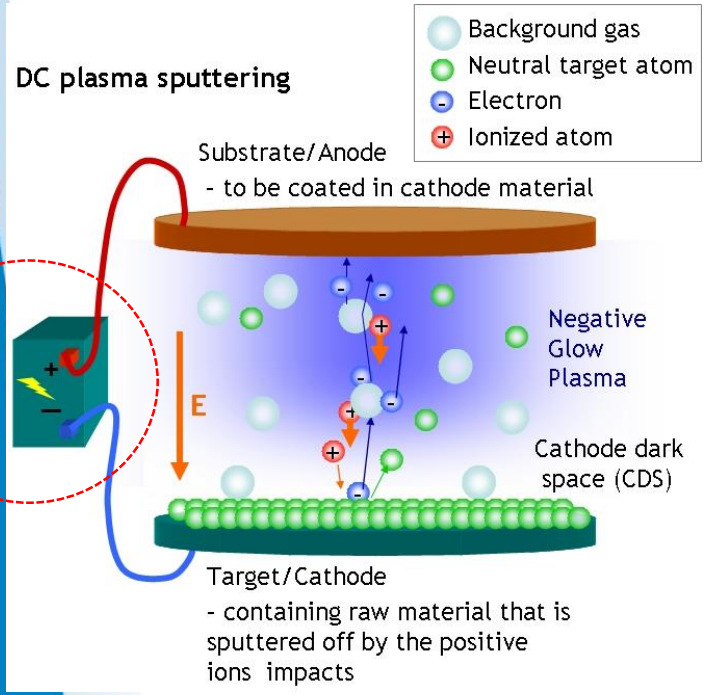
- Ar氣體原子的解離

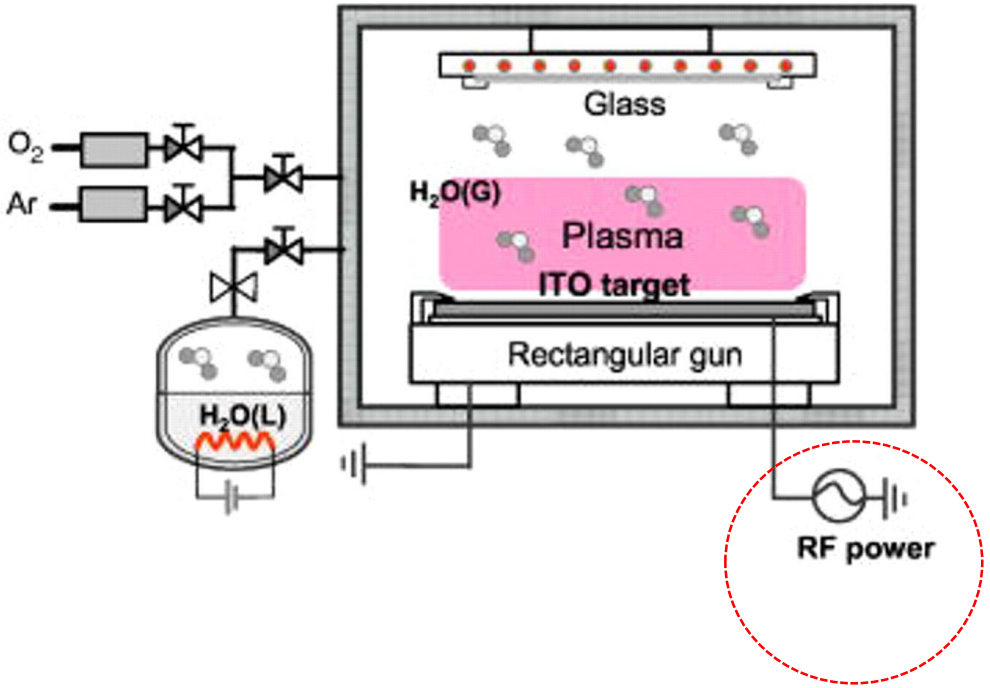
  $Ar \rightarrow Ar+ e^-$

- 電子被加速至陽極(a)，途中產生新的解離(b)。
- Ar離子被加速至陰極撞擊靶材，靶材粒子及二次電子被擊出(c)，前者到達基板表面進行薄膜成長，而後者被加速至陽極途中促成更多的解離。



DC and RF Sputtering





DC and RF Sputtering

- 直流鍍膜濺射系統只能進行金屬薄膜製鍍，射頻濺射鍍膜系統不論金屬薄膜或介電薄膜均可進行製鍍。

- 直流濺射鍍膜系統會有正電荷累積在介電質靶材上的問題，而射頻濺射鍍膜系統使用交流電源，正負電壓互相切換，電子會受到正電壓的吸引往靶材方向移動，在靶材上中和正電荷，解決正電荷累積在介質靶材上的問題，所以射頻濺射鍍膜系統可進行介電質薄膜的鍍製工作。

In-line Sputter for G5 substrate

- 以矽薄膜太陽電池為例，採用sputter鍍膜有：
  - ◆AZO:抗反射膜
  - ◆Al:背電極
  - ◆Ag:背電極

Process apparatus	Deposition
SPUTTER	Back contact(Al or Ag)
SPUTTER	AZO
PECVD	N-Layer
PECVD	I-Layer
PECVD	P-Layer
SPUTTER	TCO
	glass

Thank you!