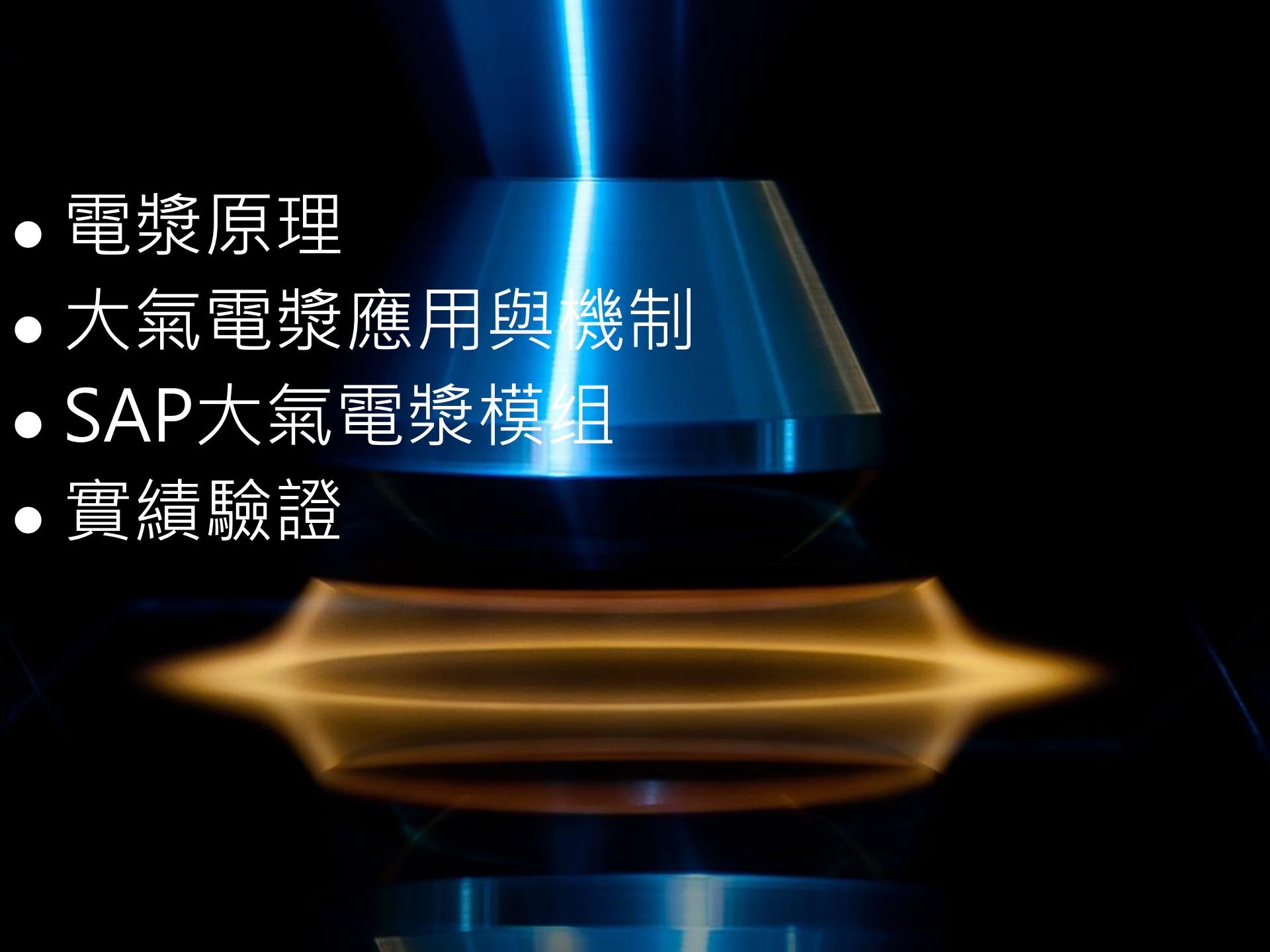
plasma
雪曼電漿科技有限公司
SHERMANN's TECH Ltd.

AP Plasma
Surface Treatment Solution on the TOP
大氣電漿領導先驅

# SAP Plasma
# 雪曼大氣電漿

## SHERMANN's
## Atmospheric Pressure Plasma

+886-2-2599-3225
splasma@sap-plasma.com



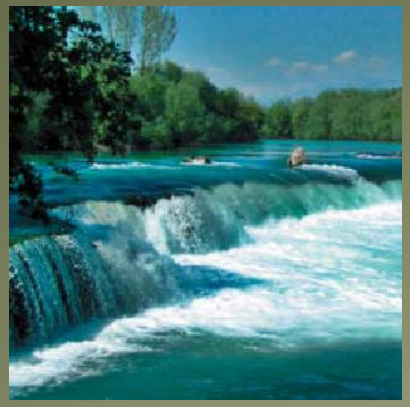
- 電漿原理
- 大氣電漿應用與機制
- SAP大氣電漿模组
- 實績驗證

# 什麼是電漿

自然界的物質三態 固、液、氣

當氣體被持續施加能量....
氣體分子便會被解離成離子態，也就是電漿。

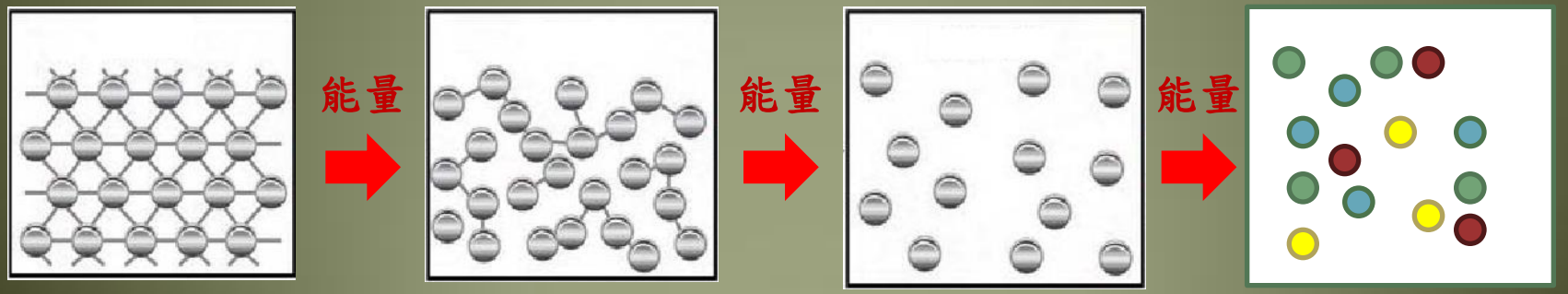
固態



液態

氣態

電漿

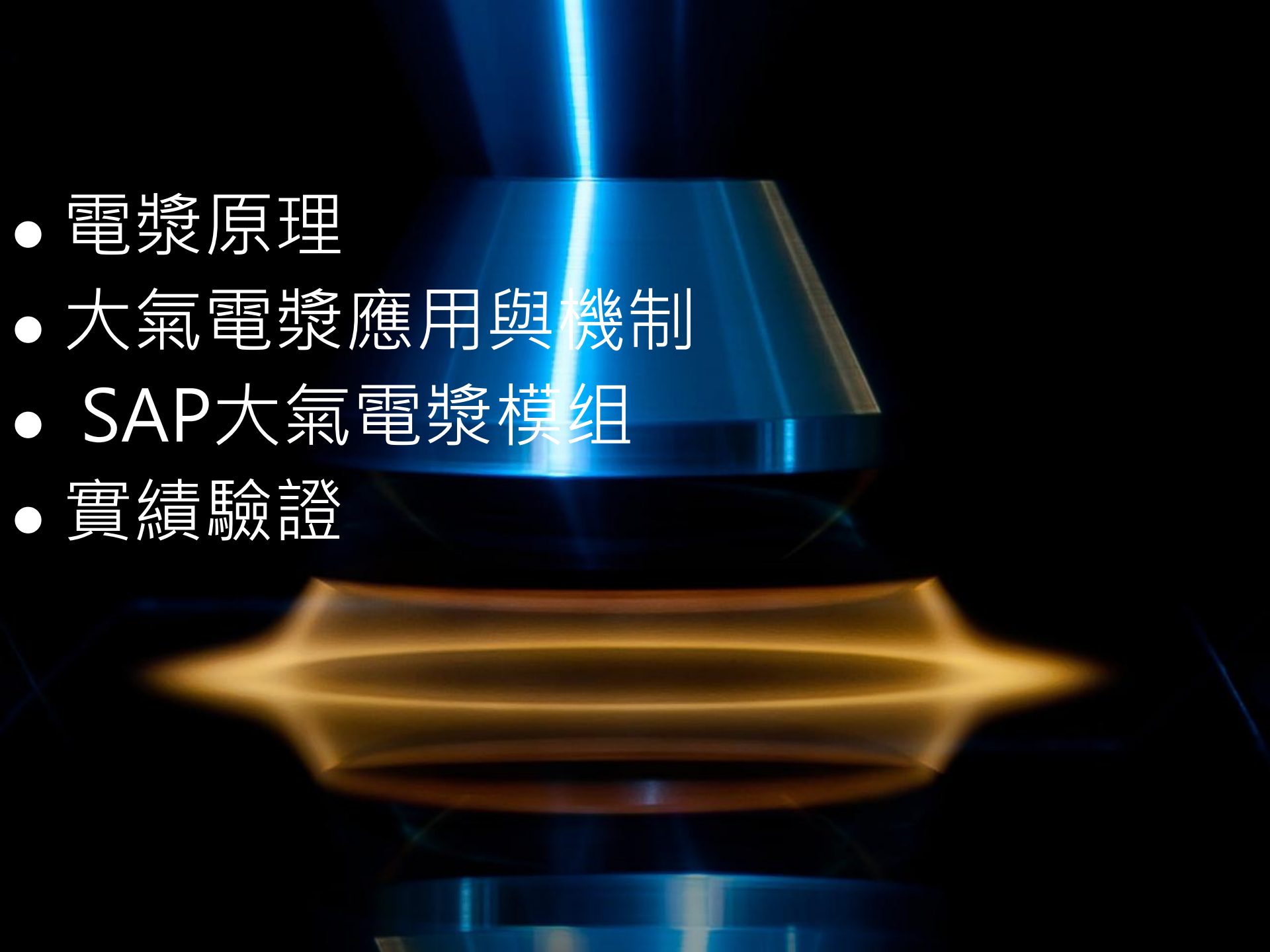


# 電漿原理

電漿內部包括:

帶電荷之電子、正離子、負離子、紫外光、中性氣體原子與自由基等物種；由於電漿處於電中性，因此也稱為等離子。

而且...離子比氣體/液體更具穿透力與活性。



- 電漿原理
- 大氣電漿應用與機制
- SAP大氣電漿模组
- 實績驗證

# 大氣電漿應用

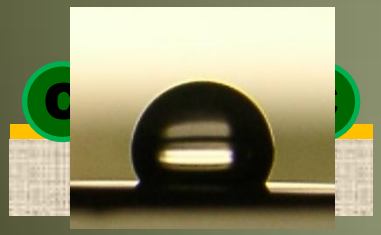
藉由離子的活性、電性與化性，電漿有許多的應用...

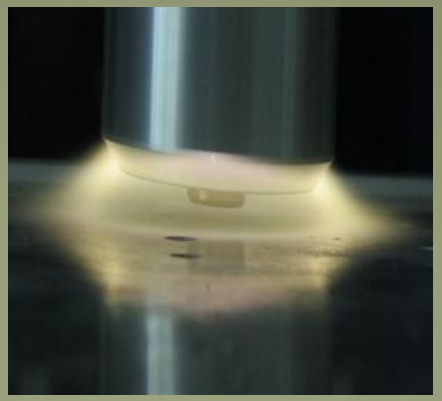
✓活化：提高表面的潤濕性能，形成活性表面。
✓清洗：去除有機質和油污，精細清洗和去靜電。
→提高表面的附著能力
→提高異質表面粘接的可靠性和持久性
✓殺菌：有效分解有機病原體
✓塗層：提供功能性的化學塗層。

# 大氣電漿原理機制

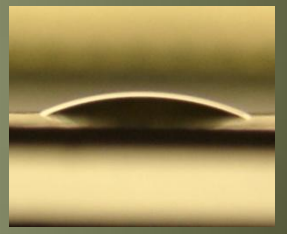
## 大氣電漿清洗機制

藉由活性很強的氧離子，
快速與碳(油脂、污漬)結合
形成二氧化碳氣體。





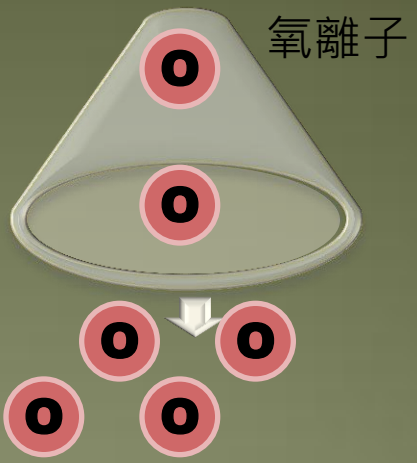
快速達到
洗淨效果
絕無死角

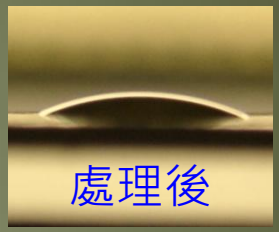


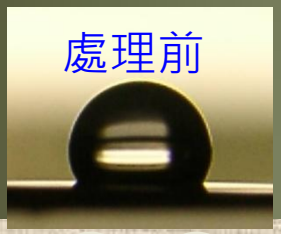
# 大氣電漿原理機制

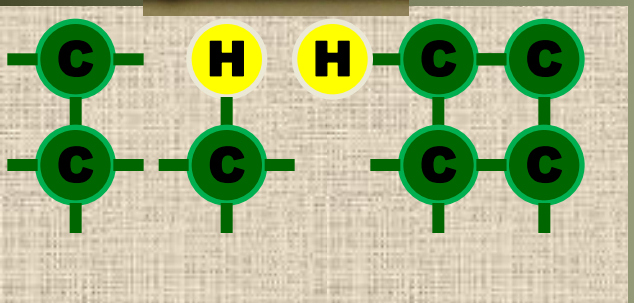
## 大氣電漿改質機制

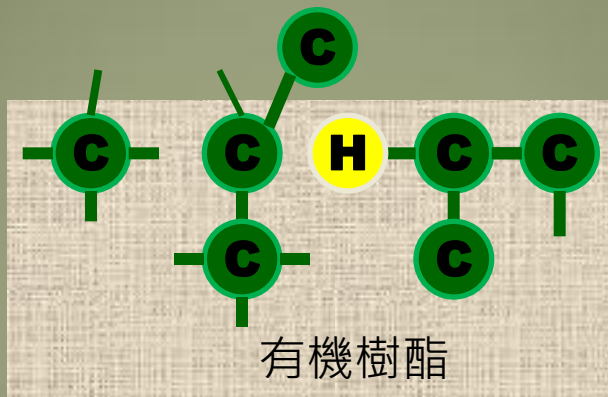
依據材質與披覆之化學品(膠水、漆、墨) ，以變頻電漿解離空氣中N2 & O2的不同比例，製造出-OH、-CH、-NH、-COOH...等極性官能基團，以化學鍵結取代傳統化學底塗貼附機制。

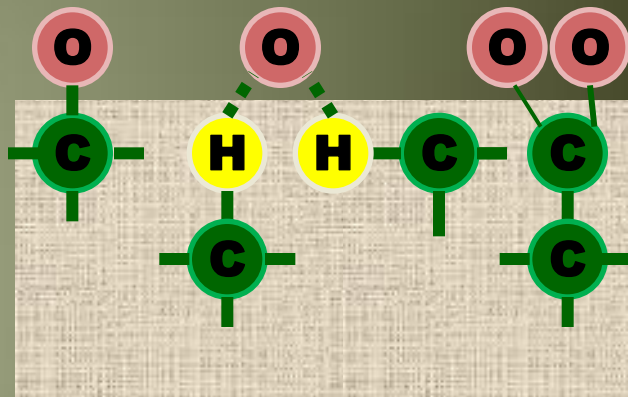


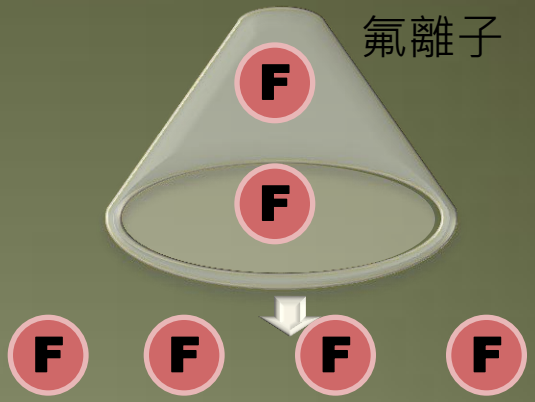



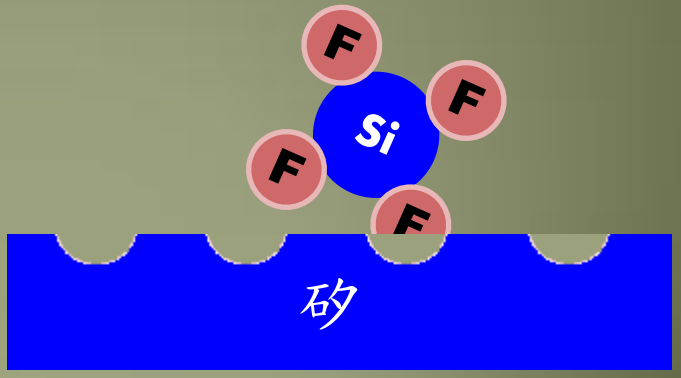
# 大氣電漿原理機制

大氣電漿

蝕刻、灰化、清洗機制

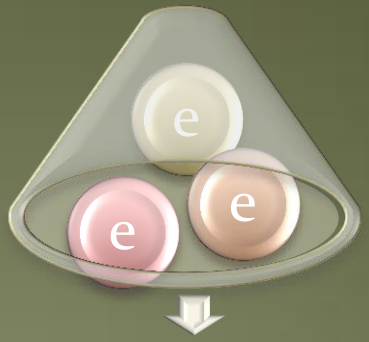
$$4F + Si \rightarrow SiF_4$$



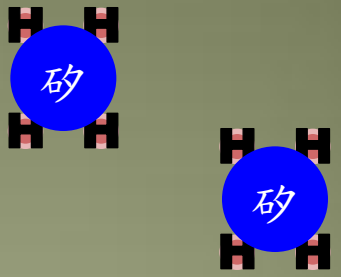



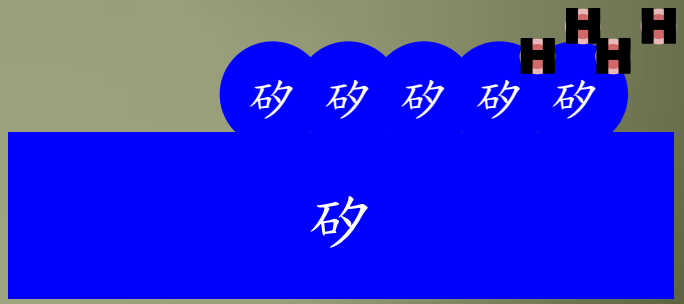
# 大氣電漿原理機制

## 大氣電漿鍍膜機制一




$e^- + SiH_4 \rightarrow Si+4H$

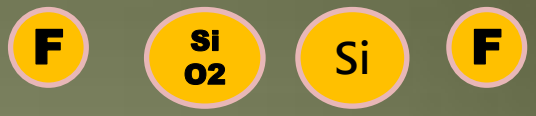


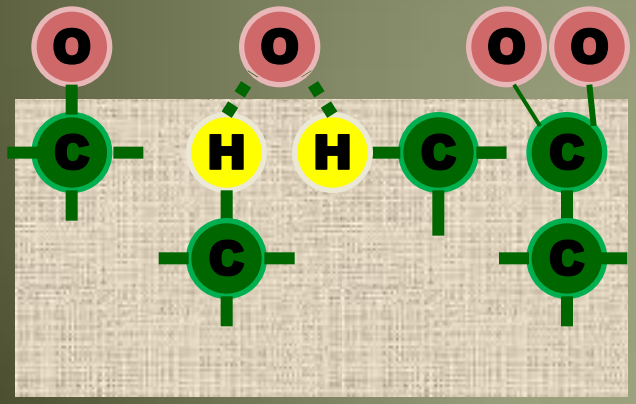



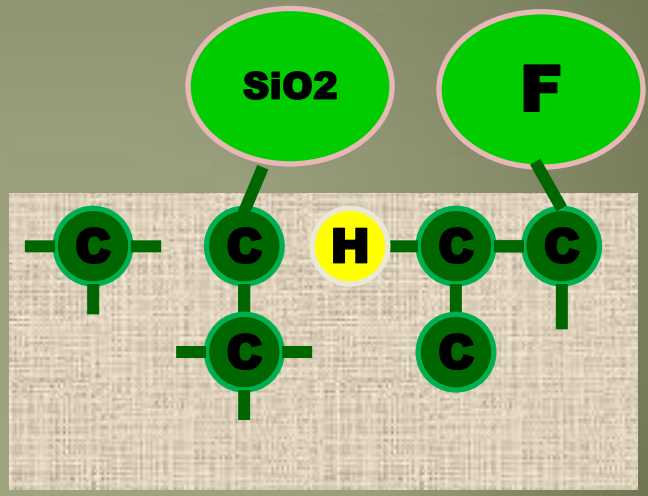
# 大氣電漿原理機制

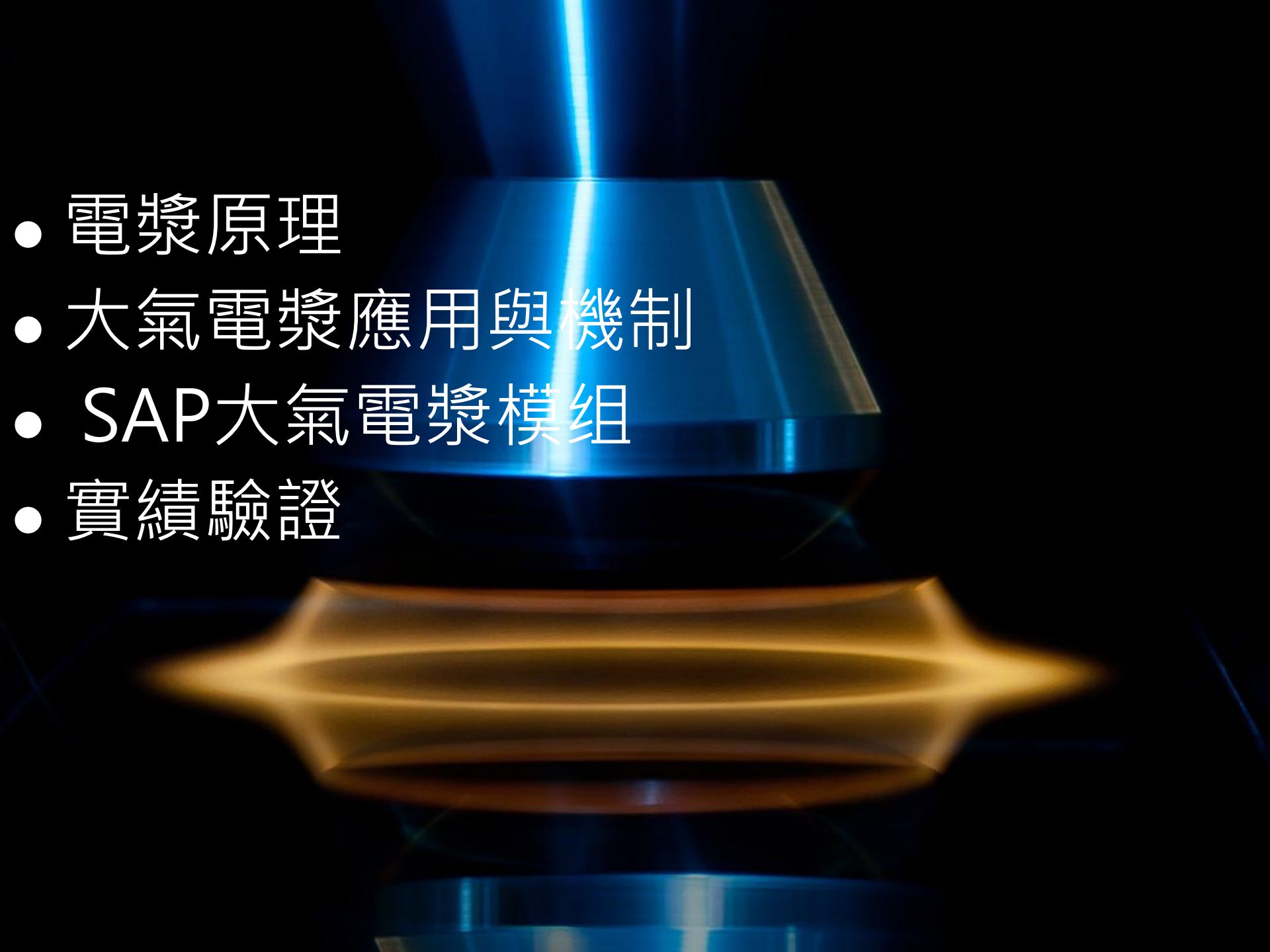
大氣電漿鍍膜機制二

1. 表面改質
2. 噴塗鍍膜





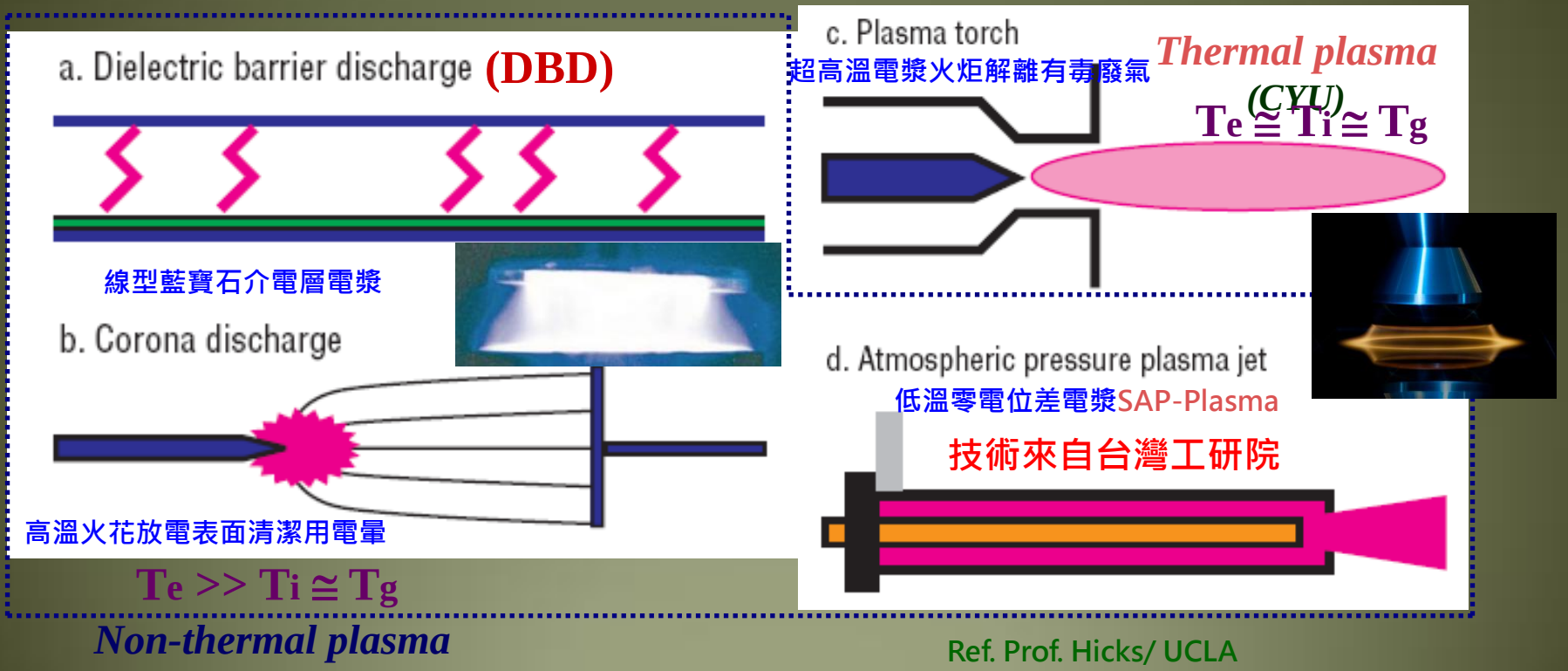
- 電漿原理
- 大氣電漿應用與機制
- SAP大氣電漿模组
- 實績驗證

# SAP大氣電漿模組

大氣電漿可分為四大類型:

A. DBD 介電層電漿(線型或感應式)、 B. 電暈 (高溫高電流、火花放電)

C. 噴射式電漿 (高電壓低電流<80C)、 D. 火炬電漿 (大電流超高溫>1000C)




氧離子濃度比較

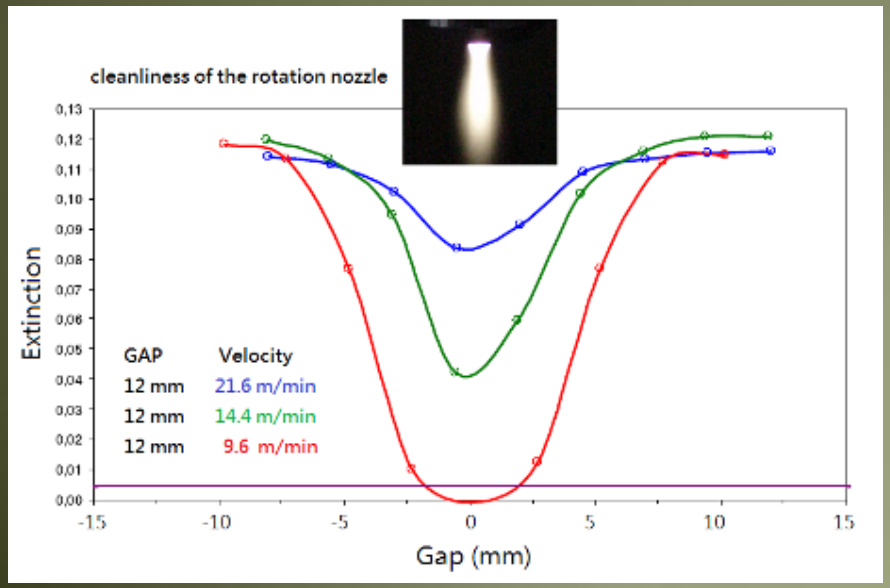
SAP噴射式電漿$10^{12}$>電暈/DBD $10^{10}$

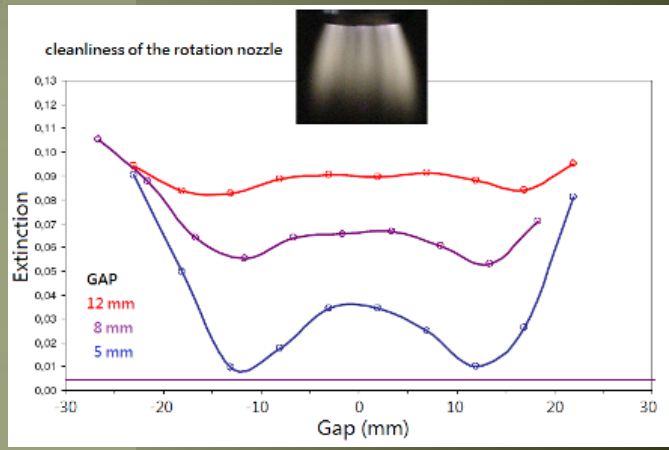
臭氧濃度比較

SAP噴射式電漿$10^{16}$ < 電暈/DBD $10^{18}$

# SAP大氣電漿模組

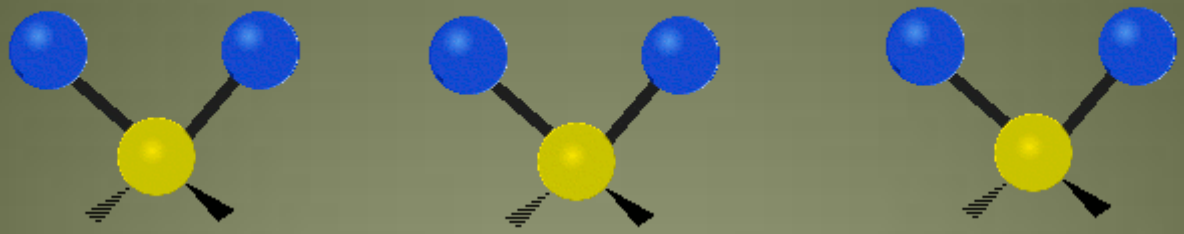
大氣環境下的電子路徑短，多半電漿只能在真空環境下被穩定地激發。雪曼大氣電漿乃藉由渦旋氣流與電性匹配，始能穩定地在大氣環境下激發出高電壓低電流的低溫噴射式電漿。





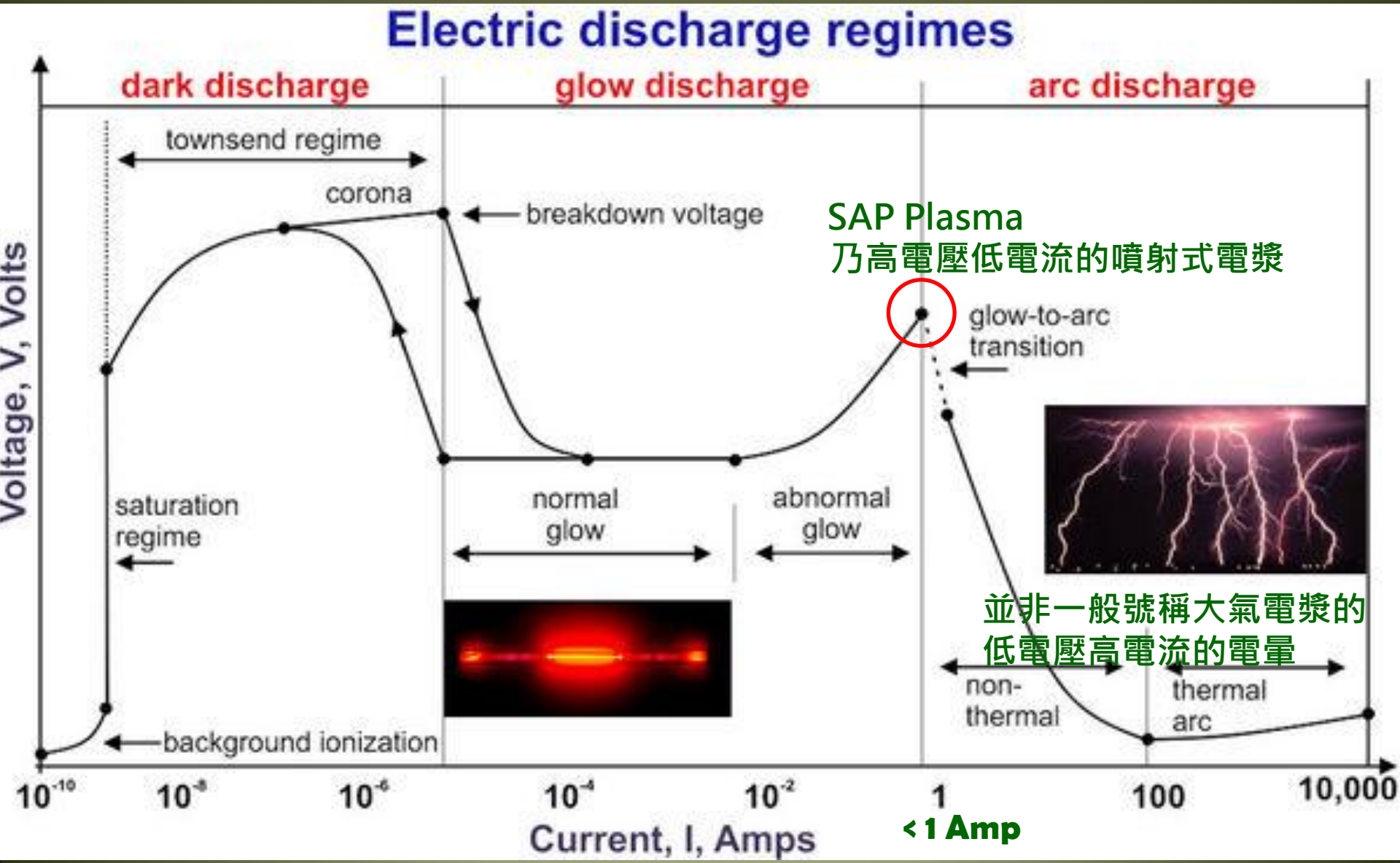
# SAP大氣電漿模組

藉由不同電漿頻率，解離空氣中不同比例的N2/O2，佈植適當的極性官能基(polar-functional group)。
要解離分子靠的是高電壓加速電子....
加大功率用蠻力斷鍵當然是一種選項....



但更聰明的是...
找到**分子間的震動**頻率，藉由共振效應來斷鍵，有效率的製造radicals。
太極拳不就是借力使力的智取嗎?

# SAPP Module


Electric discharge regimes
dark discharge
glow discharge
arc discharge
townsend regime
corona
breakdown voltage
SAP Plasma
乃高電壓低電流的噴射式電漿
glow-to-arc transition
saturation regime
normal glow
abnormal glow
並非一般號稱大氣電漿的
低電壓高電流的電量
non-thermal
thermal arc
background ionization
Voltage, V, Volts
10^-10
10^-8
10^-6
10^-4
10^-2
1
100
10,000
Current, I, Amps
< 1 Amp

# SAPP Module

| SHERMANN TECH. Ltd. | | |
|---|---|---|
| SAP VI/SI Power Supply | | |
| Voltage | VAC | 220 Single 50/60Hz |
| Rated Power (Single) | KW | 2.82 |
| | KVA | 4.86 |
| Max. Input Current | A | 22 |
| Output Power | Wrms | 300 ~ 999 (±5%) |
| Output Frequency | KHz | SAP-VI series 20.0 ~ 40.0 (±0.1%)<br>SAP-SI series 21.0 ~ 33.0 (±0.1%) pre-set |
| Unloading Voltage | Vp-p | 12K |
| Loading Voltage | Vp-p | 6K |
| Output Current | Arms | 0.2 ~ 1.2 |
| Interface | RS485 | SAP-VI4.0<br>5", 800x480(16:9), 64k Colors, TFT-LCD, WinCE, Internet |
| | External Control | SAP-SI01 No Panel, Pre-set |
| | | SAP-VI4R Keypad, Adjustable |
| | 1~2 | Activate Remote Power Switch |
| | 3~4 | Activate Remote Emergency Stop Switch |
| Standby Power | W | 50 |
| Pre-Input Air Time | sec | 1 |
| Cooling Air Relay Time | min | 2 |
| Air Pressure Input | $kgf/cm^2$ | Pre-Set 5.0 (±0.5) |
| Air Pressure Alarm | $kgf/cm^2$ | Pre-Set 4.0 (±0.5) |
| Output Air Setting | $kgf/cm^2$ | Panel (>2.0) |
| Flow Rate | slm | 40 @2.0 $gf/cm^2$ |
| Over Heat | ℃ | 75 Cut/70 Reset |
| Rated Efficiency | % | 100 (<40℃) |
| Operating Temp. | ℃ | +5~+50 |
| Storage Temp. | ℃ | -10~+60 |
| Insulation Class | | H |
| Protection Class | | IP21 |
| Gounding | | First Class: Resistance < 10Ω、<br>Copper Wire OD>5.5 $mm^2$ |
| Dimensions | mm | W=292 、D=605、H=445 |
| weight | Kg | 25 |

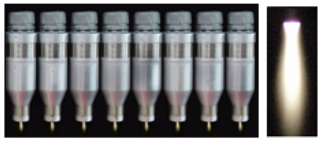
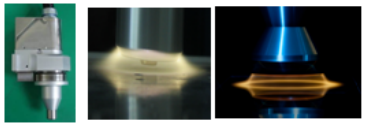
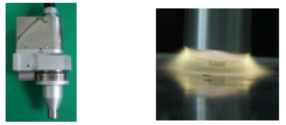
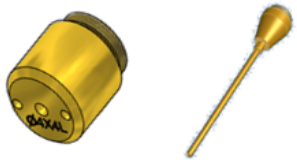
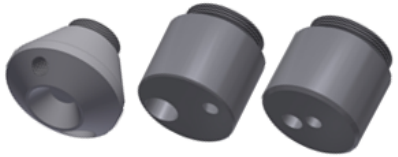
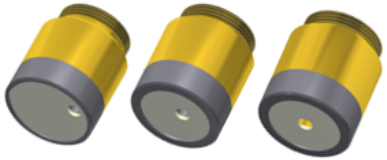
## 高電壓(>6kV)電源供應器

# SAPP Module

註一、變頻電漿得激發適當之自由基與基材反應，對材質表面進行化學接枝與改質，形成化學鍵結，有助低溫生產。

註二、市售等離子呈藍色火焰狀，代表化學自由基(radical)濃度不高，但電子溫度極高，並非最佳等離子狀態。

台灣雪曼電漿科技公司之大氣等離子模組，以40 liter/min壓縮空氣即可穩定點燃<80C、富含超高濃度之離子、自由基等狀態之黃色火焰狀的等離子團。

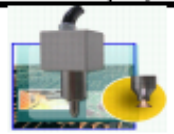
| | HZ02 | SR02 | HZR02 |
|---|---|---|---|
| 電漿產生器 |  |  |  |
| | 噴嘴 iZ Φ4/ NiZΦ4 | 旋轉噴嘴 iZ Φ50/Φ20/Φ8 | 旋轉噴嘴 NZ Φ20/Φ15/Φ4 |
| 噴嘴(可搭配) |  |  |  |
| 表面處理線速度 | 50 m/min max. | 9.6~14 m/min | ~21.6 m/min |
| 旋轉馬達 | NA | DC24V – 36W >1600 rpm | DC24V – 37W >1800 rpm |
| 重量 | 0.42kg | 5kg | |
| 線長 | ~ 3m | | |
| 尺寸 | 42mmW×123mmH×⌀42mm | 82mmW×226.5mmH×125mm | |
| 有效處理高度 | 5~15 mm | 6~10 mm | 5~12 mm |
| 電極/噴嘴保證壽命 | >6k 小時 | ~ 3k小時 | ~ 6k小時 |
| 絕緣套件組 | 陶瓷 | | |
| Arcing | 部分 | 部分 | Arcing Free |
| 氣體流量 | ~40 liter/min @2kg air | ~40 liter/min @2.5kg air | ~40 liter/min @2kg air |
| 操作氣體 | AIR、N2、O2... | | |
| 一般耗材 | NA | 橡膠皮帶 (>3k小時壽命) | |
| 適用材質 | 金屬、塑料、玻纖、碳纖、橡膠、玻璃、陶瓷.... | | |

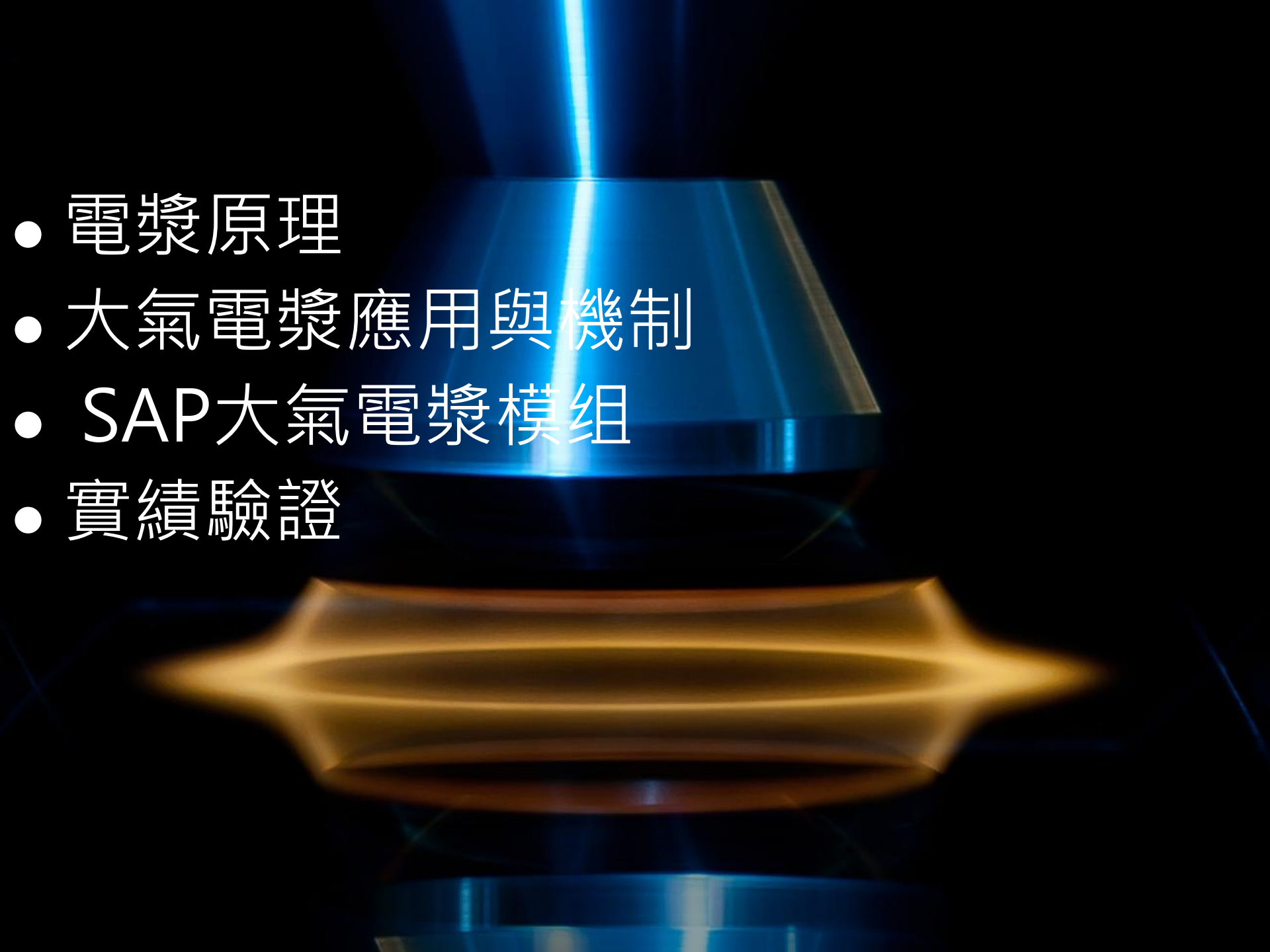
# SAPP Module

## AP Plasma BenchMark

Are you looking for AP-Plasma or ozone generator?

差異比較

| 廠牌 | 台灣雷曼電漿科技<br>SAP-Plasma | PxxxTxxx | 其他 Others |
|---|---|---|---|
| 技術來源 Resource | Taiwan ITRI | Germany Frxxxxx | unknown |
| 專利 Patents | ~56 | ~40 | unknown |
| 營業模式 Model | Total Solution | Auto. Equipment | Auto. Equipment |
| 技術比較 Diff. | | |  |
| 電源 Power | 1~10kW | 1~10kW | 1kW |
| 激發頻率 Freq. | Adjustable 15~40 kHz | 20~40 kHz | Fixed 21/40 kHz |
| 槍頭 Generator | Straight/Spin patented | Straight/Spin patented | Straight/Spin patent??? |
| 噴嘴 Nozzle | Arcing Free<br>Φ 4, 8, 15, 20, 50mm | Partial zero potential<br>Φ 4, 20, 50mm | Arcing Plasma or<br>Ozone Generator??<br>Φ 4 or 20mm |
| Scanning Line Speed<br>(M/min)/($cm^2$/min)<br>(CA<10 @ glass) | >20<br>> 4k | >20<br>> 4k | <<10<br><< 1k |
| Nozzle Life Time | > 6k hrs | > 6k hrs | 500 hrs |
| Plasma Species | $O_2$ Radial ~ $10^{12}$/$cm^2$ | $O_2$ Radial ~ $10^{12}$/$cm^2$ | $O_2$ Radial <<$10^{12}$/$cm^2$<br>Ozone |
| 操作溫度 Temp. | <80°C | <80°C | >100°C |
| 操作氣體 Gas | AIR、N2、O2... | AIR、N2、O2... | N2、O2、mixed Gas |
| 化學品搭配<br>Chemical Solution | YES | - | - |

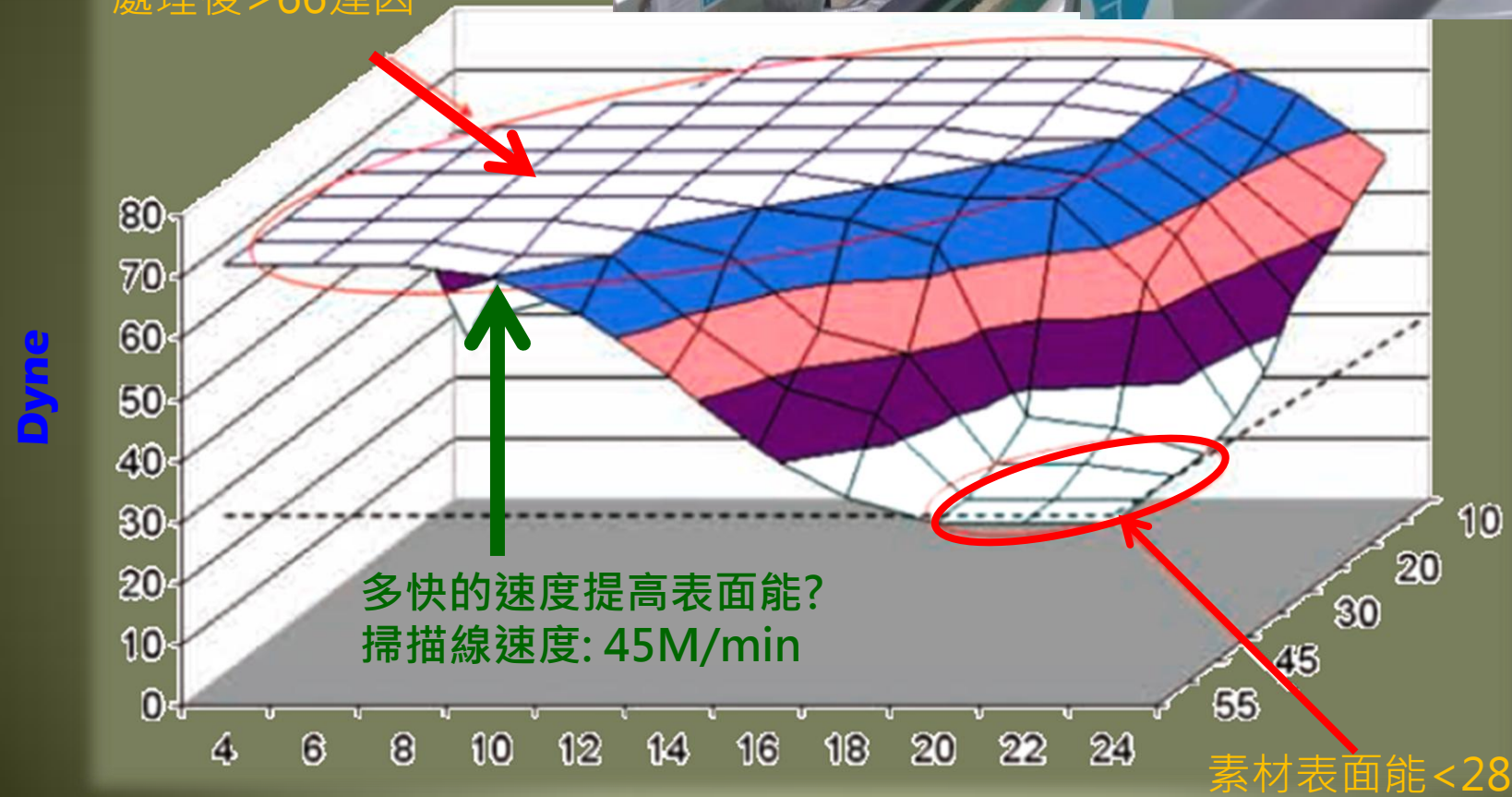


- 電漿原理
- 大氣電漿應用與機制
- SAP大氣電漿模组
- 實績驗證

# 表面能

## 有機高分子

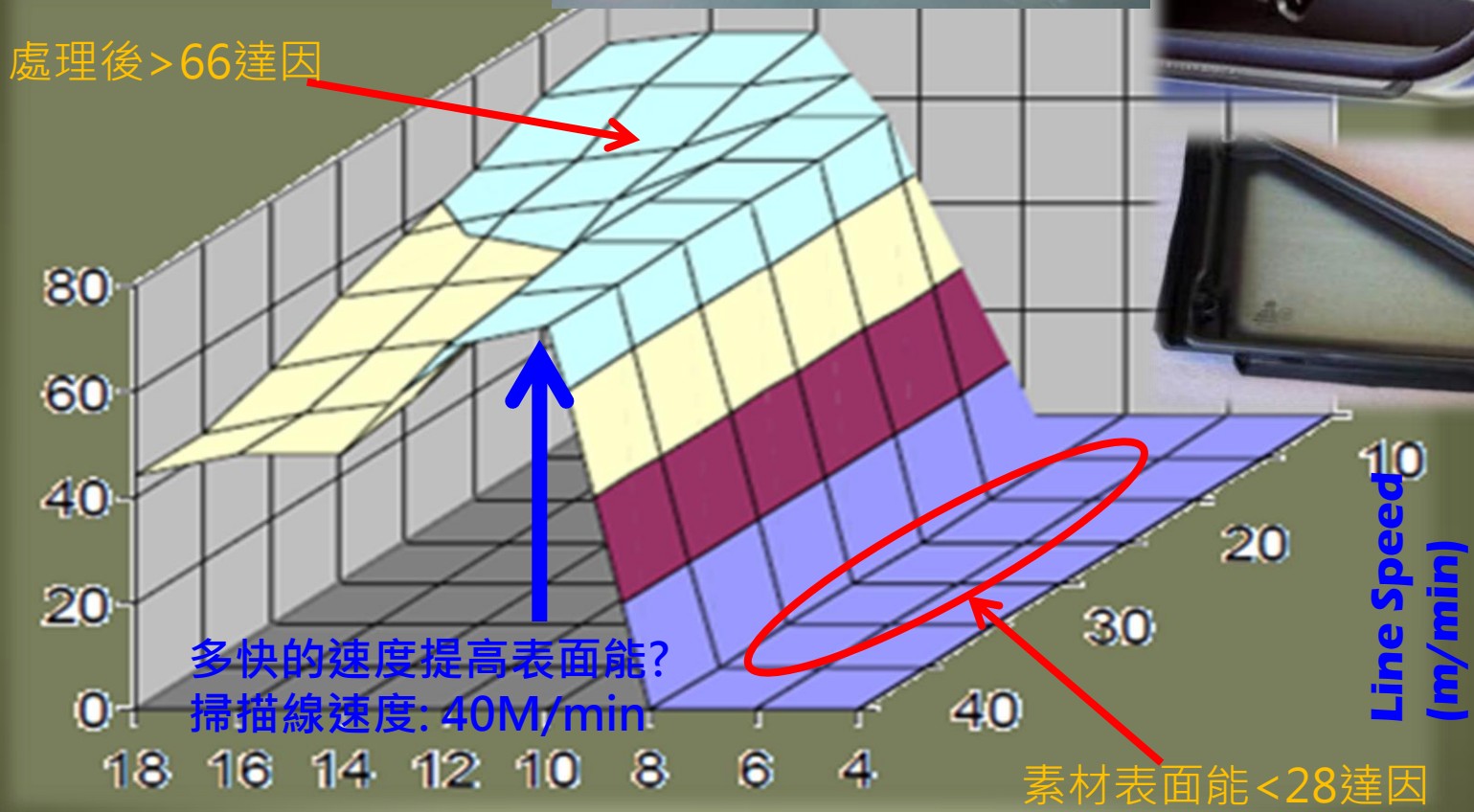
處理後>66達因



# 表面能

TPE/橡膠/EVA

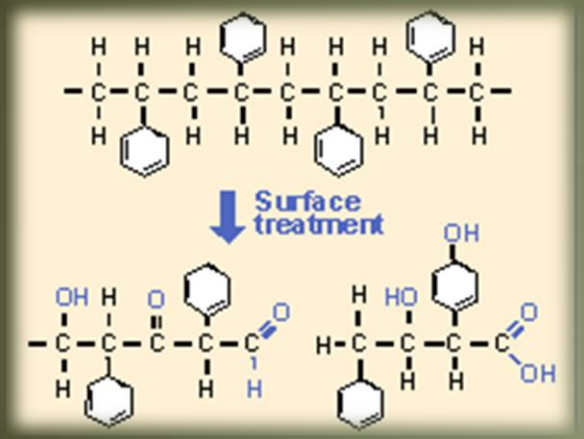
處理後>66達因



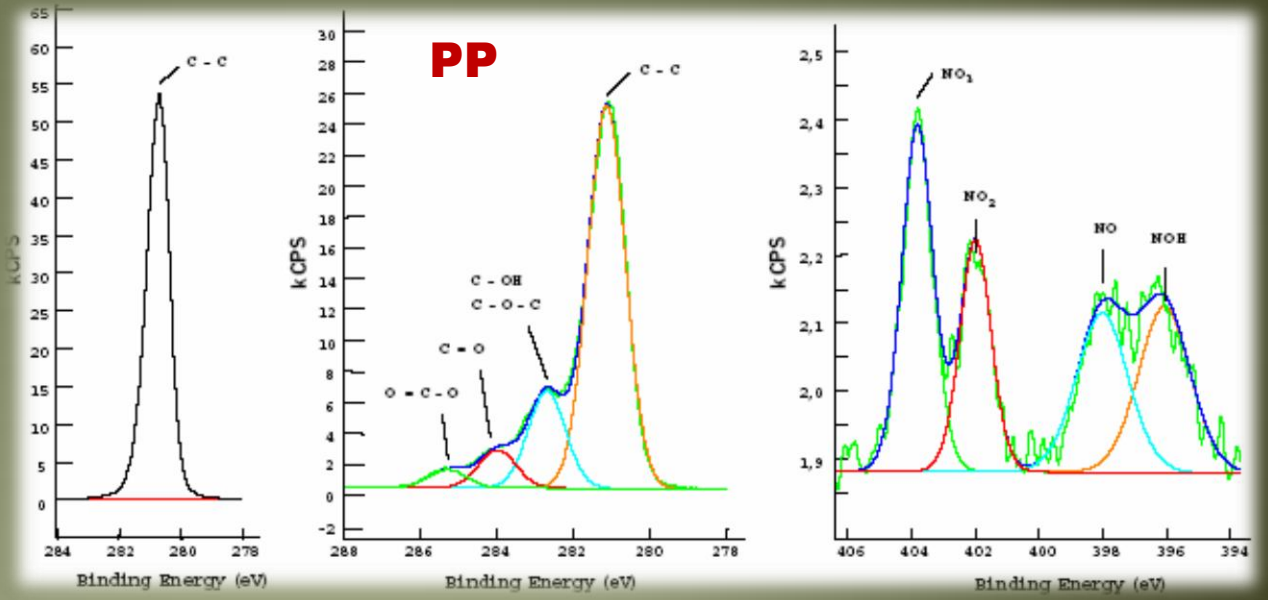
# 表面改質（FTIR)

## 有機高分子材料

改變表面能有太多種方式...但改質...就不是一般號稱大氣電漿也可以做得到的
唯有變頻電漿，始可適應各種材料，且同時達到改質、清潔、活化表面功效。




↑ Functional Groups



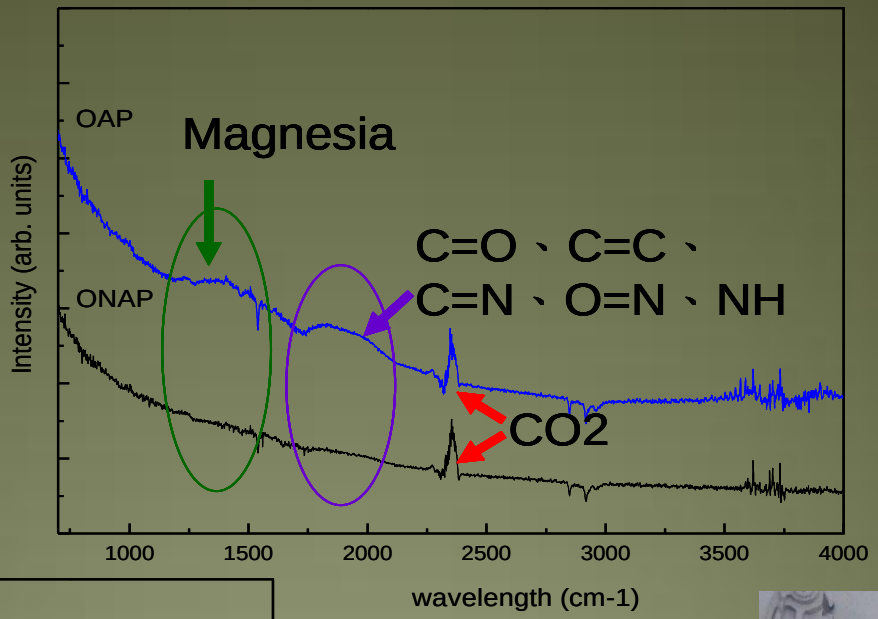

**Before**
**Surface energy**
**27 mN/m**

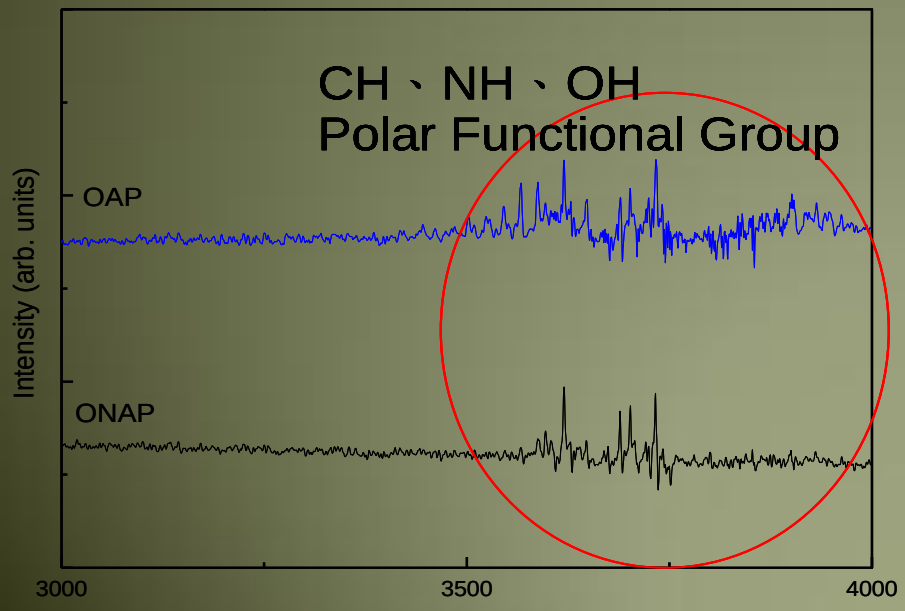
**After**
**72 mN/m**

# 表面改質

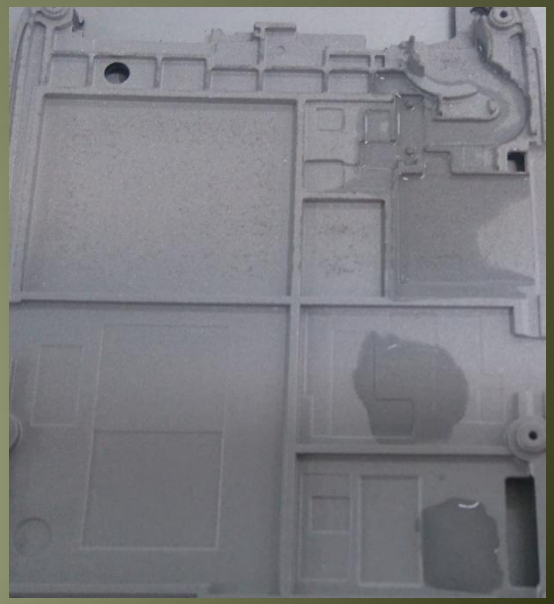
## 金屬 (鋁/鎂)

無須化學品
無須濕式電化學
只需要空氣 ... 即可改質



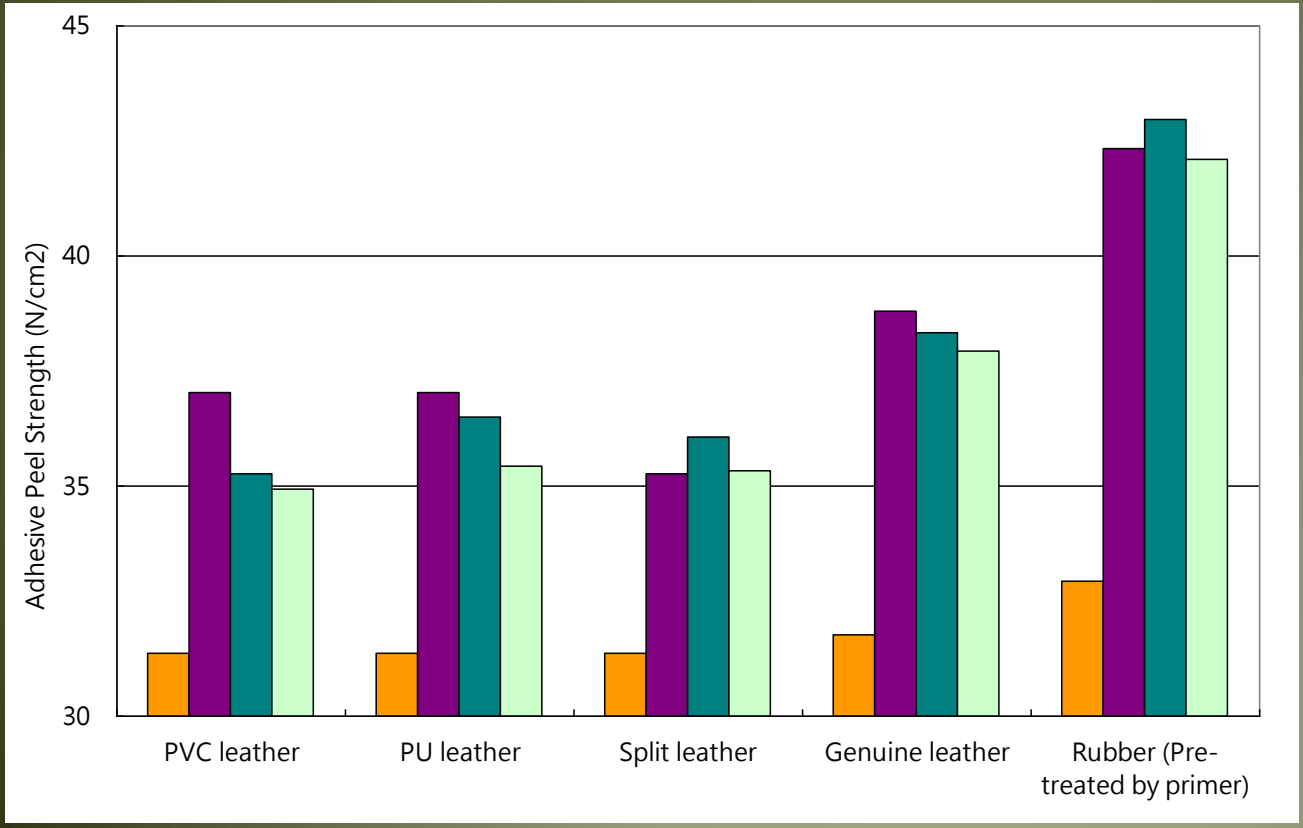




SAP-Plasma
處理後水滴擴散
而不只是攤平而已



# 貼合強度測試

藉由空氣電漿改質，取代化學底塗，形成化學鍵結。




EVA & leather pre-treatment

- Not UV primer
- UV primer
- SAP Plasma (directly bonded)
- SAP Plasma (bonded after 1hr WBT)

**Water-Based Adhesive without Hardener**
Curing at 80℃ x 2 hr

**Leather w/o polished**

工業技術研究院
Industrial Technology Research Institute

since 2005

Engineering
Shermann Ph.D.

plasma
雪曼電漿科技有限公司
SHERMANN's TECH Ltd.

- RD
  - Chemical
  - Process
  - ME
  - Supplier
  - EE
- PE & QC

展示工廠 @
台北/桃園/新竹/台中

開放實驗室. @
工研院/清華大學

# SHERMANN Atmospheric Pressure Plasma (SAP-Plasma)

**以大氣電漿高能化學改質技術，取代傳統酸鹼洗與有機溶劑噴塗，帶領跳脫框框思維的創新制程；導入更多配套的環保工藝(水性漆噴塗、水性膠等等)，讓科技造就可以呼吸的未來。**

營業項目：大氣等離子模組製造(變頻電漿模組)與銷售
可搭配自動化與化學品

應用材料：金屬、玻璃、塑膠、橡膠、紙類、複合材料、碳纖、玻纖、紡織纖維

適用產業：電鍍、塗裝、塗膠、3C、印刷、食品包裝、汽車、醫材、運動用品、太陽能、民生用品、紡織...etc.

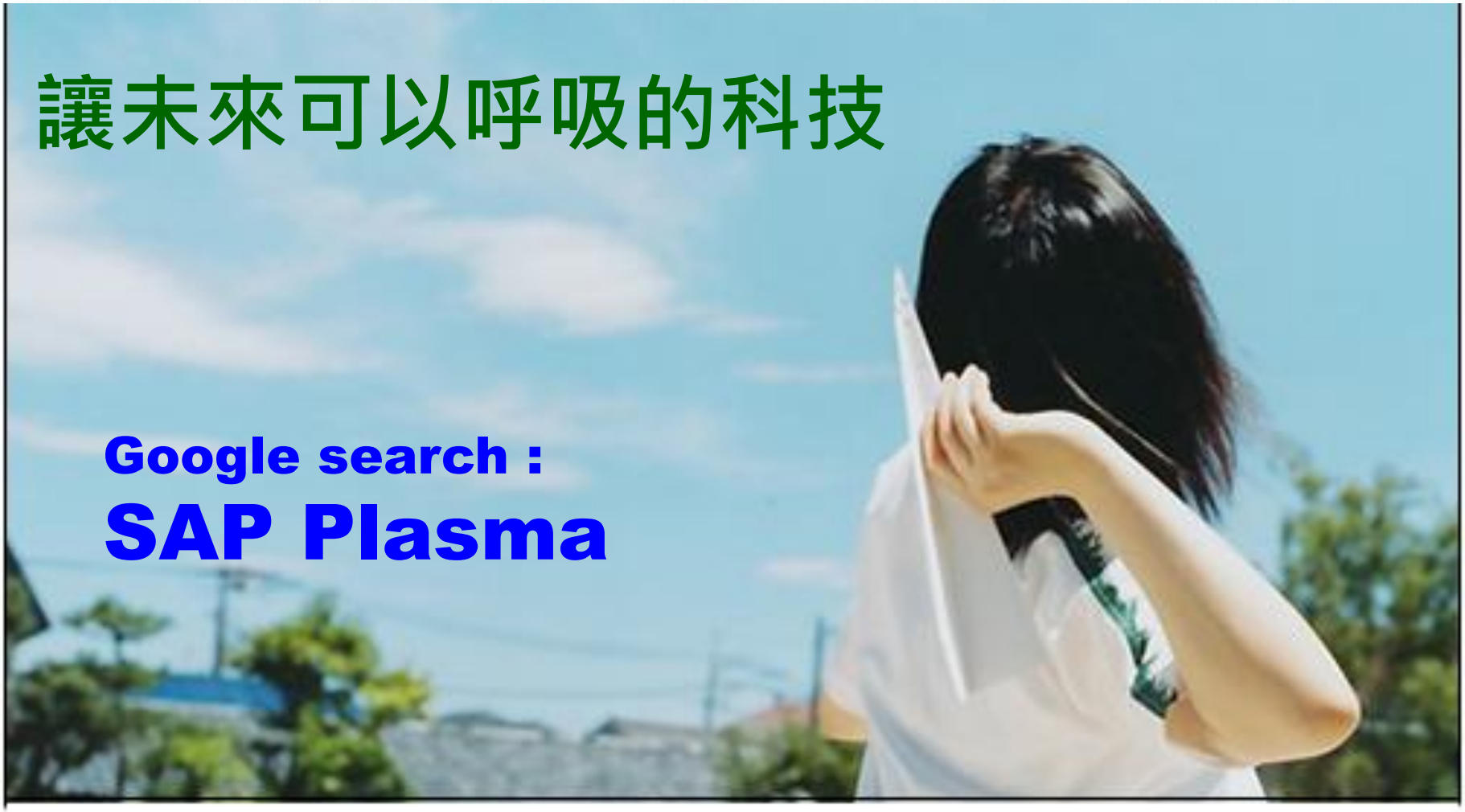
plasma

雪曼電漿科技有限公司
SHERMANN's TECH Ltd.

# AP Plasma

**Surface Treatment Solution on the TOP**

## 大氣電漿領導先驅



plasma
雪曼電漿科技有限公司
SHERMANN's TECH Ltd.