塑膠電鍍介紹
Plating on Plastics

塑膠電鍍介紹 Plating on Plastics

塑膠電鍍原理及注意事項Principles of Plating on Plastic

第一站 素材選擇 ABS塑料案例 (Step 1:Selecting Material ABS Plastic Case)

1.最好採用電鍍級ABS塑膠如圖所示其丁二烯含量15%~16%密著強度最好 Selects the ABS plastics showing on the right which the butadiene is 15%-16%.Its adhesion is best.

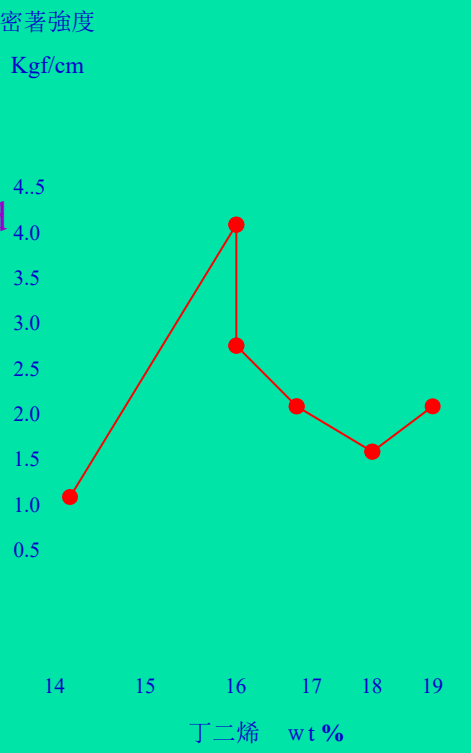
2.采用70%~95%PC+ABS材料要請供應商提供防火材料%、PC%、等相關資料 Applier should offer fireproof material, PC%,etc,and references before selecting 70%-95%PC+ABS.

3.塑膠電鍍原料應完全乾燥(含水率0. 1%以下) Materials of plating on plastic should be dried totally.

4.塑膠電鍍原料盡量避免染色

Materials of plating on plastic must prevent dyeing.

5.塑膠電鍍原料UL認證 Materials of plating on plastic should be attested by UL.



各材質丁二烯之含量

塑膠電鍍介紹 Plating on Plastics

塑膠電鍍原理及注意事項

第二站 模具設計 Step2:Mould Design

1.塑膠電鍍模具必須預留電鍍夾具掛架點(以防產品變形及生產便利性)

Remains points for electroplating rack in mould of plating on plastic .

2.模具設計趨向：耐高溫不易頂開產生毛邊、射出點不可太細以防入水斷裂脫　落、預防尖端放電(加框)、注意離模斜度、預留排氣孔、注意頂針粗細影響外觀及進膠口位置產生之結合線等Trend of moulds design: Moulds should of be resistant to high temperature and not easily open to create crude outline, the ejection point should not be too small to prevent entering water and breaking. Prevents discharge of tip. Reminds the ventilator. Pays attention to that thickness of tip will influence the exterior and the combination line created in the ejection hole.

塑膠電鍍介紹 Plating on Plastics

3.塑膠電鍍模具成型盡量避免尖端設計，盡可能改為R角

Adopts round corner instead of tip corner in mould design.

4.模具孔洞盡量設計導通，預防殘留藥水不易清洗

Designs passage in the hole to clean the remnants.

5.模具需預留電鍍後膜厚及組裝間隙

Remain the thickness of membrane which formed after electroplating.

塑膠電鍍介紹 Plating on Plastics

塑膠電鍍原理及注意事項

第三站 成型射出 Formation and Ejection

1.脫模劑最好能不用，要用務必使用含氟水性脫模劑Avoid using the mould releases,if it is essential to use one,the Fluorine-type may be used springly.

2.射出參數在不頂模、不起毛邊狀況下，盡可能拉高樹脂溶解溫度及模溫溫度，降低射出壓力及射出速度，以減少應力產生The ejection parameter such as plastic Tm and mould tempreture should rise as high as possidble and the ejection stress and speed should be reduced to lessen the stress.

3.成形表面確認：不可有感結合線、刮痕、頂凸、拉模、縮水、起蒼、包風、及異色點(浮出表面上)等等Affirming the surface:There must be no combination line ,scratch,etc.

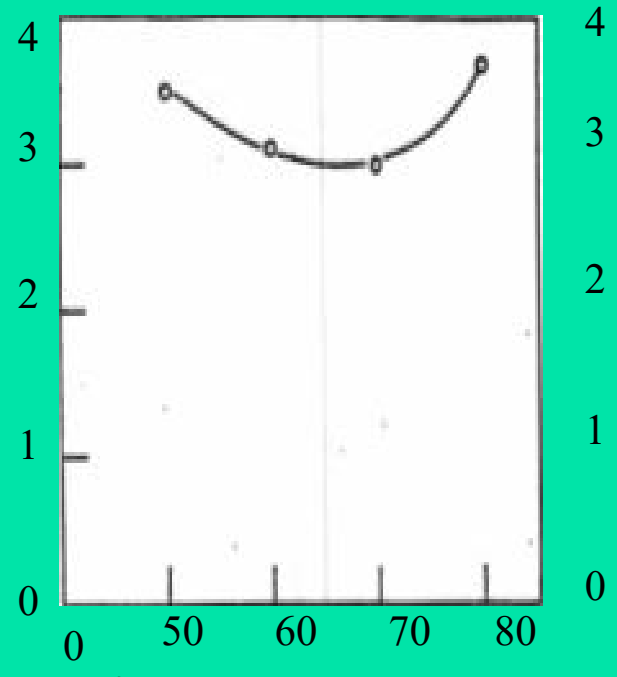
4.成型品包裝：用Tray(托盤)+紙箱，以防碰刮傷Packing:adopt tray and paper case to prevent being scratched.

5.尺寸確認：依廠商訂定長寬尺寸、範圍Affirming the size:decides the size and range of lenth and width according to the requirement of the firm.

塑膠電鍍介紹 Plating on Plastics

塑膠電鍍原理及注意事項

密著力(kgf/cm)Adhesion

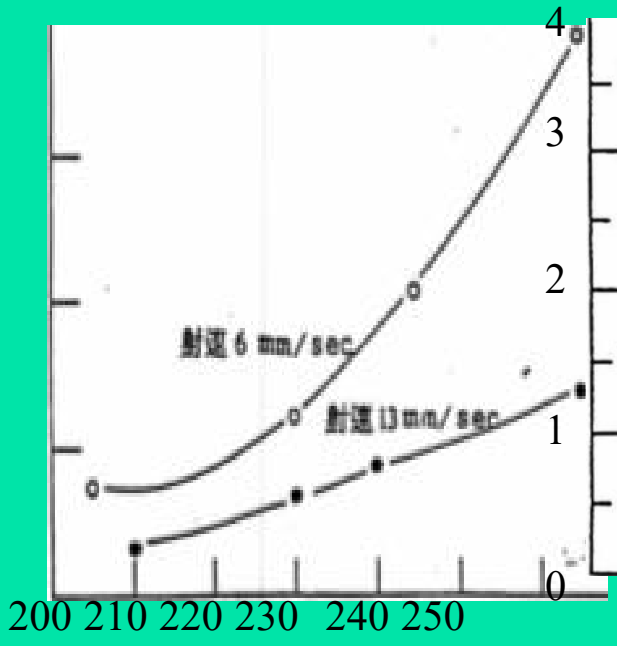


模溫 (˚C)tempreture of mould

模溫與密著力關系

relation between tempreture of mould and adhesion

密著力(kgf/cm)Adhesion

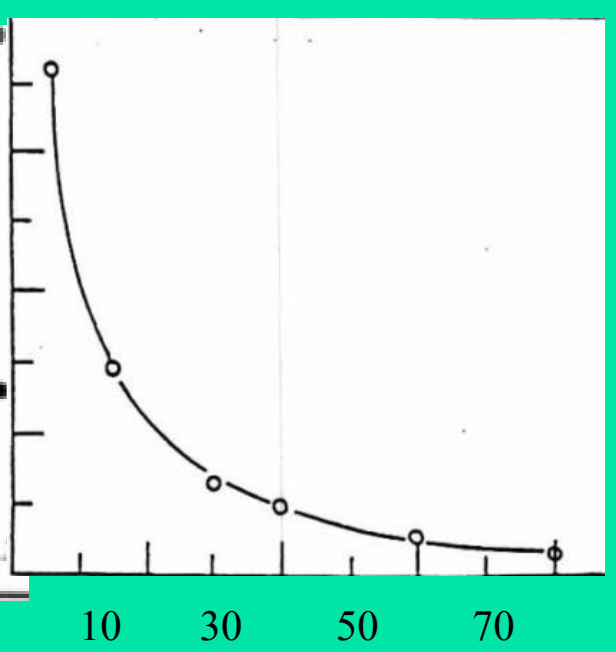


溶融溫度 (˚C)tempreture of plastic melting

樹脂溶溫度與密著力關系

relation between plastic melting temperature and adhesion

密著力(kgf/cm)Adhesion



射出速度(mm/sec)speed of ejection

射速與密著強度關系 relation between speed of ejection and adhesion

塑膠電鍍介紹　Plating on Plastics

塑膠電鍍原理及注意事項

第四站 防鍍方式　Methods of Plating-proof

1.與機構R&D、RF、EMI、ESD、電子等人員討論絕緣區位置、熱溶點位置、卡勾防鍍、耳機孔迴朔、EMI歐姆值

Discusses position of insulation area and melting point ,plating-proof of hooks in rack ,EMI ohm.

2.防鍍方式：噴塗、貼膠、蝕刻、照影 、印刷 (依需求而決定)

Method of Plating-proof :spraying paint, etching, printing ,etc. (decided by requirements)

塑膠電鍍介紹Plating on Plastics

工業塑膠表面處理比較表

項目 / 方法	電器電鍍	彩色電鍍	真空濺鍍 +UV烤漆	I.M.D	PU烤漆	UV烤漆	PVD TiN ZrN	水轉印
耐磨性R.C.A	優良通過	優良通過	通過	通過	NG	通過	優良通過	NG
硬度	>9H以上	5H	3H	4H	2H	3H	>9H以上	2H
耐溶劑	優良	優良	優良	優良	NG	優良	優良	NG
抗紫外線	優良	優良	優良	通過	通過	優良	優良	NG
表面細膩	優良	優良	普通	優良	普通	普通	優良	普通
邊緣覆蓋	優良	優良	普通	普通	普通	普通	優良	普通
膜厚均勻	優良	優良	普通	普通	普通	普通	優良	普通
金屬感	優良	優良	普通	普通	普通	普通	優良	普通
量產性良率	普通	普通	優良	優良	優良	優良	普通	優良
作業性	複雜	複雜	普通	普通	普通	普通	複雜	普通
電子功能 EMI ESD	優良	優良	需二次加工	需二次加工	需二次加工	需二次加工	優良	需二次加工
液體垂涎	不會	不會	會	會	會	會	不會	會
灰塵毛屑附著	不會	不會	會	會	會	會	不會	會
技術性	高	高	普通	普通	普通	普通	高	普通
價格	普通	貴	普通	普通	普通	普通	最貴	普通

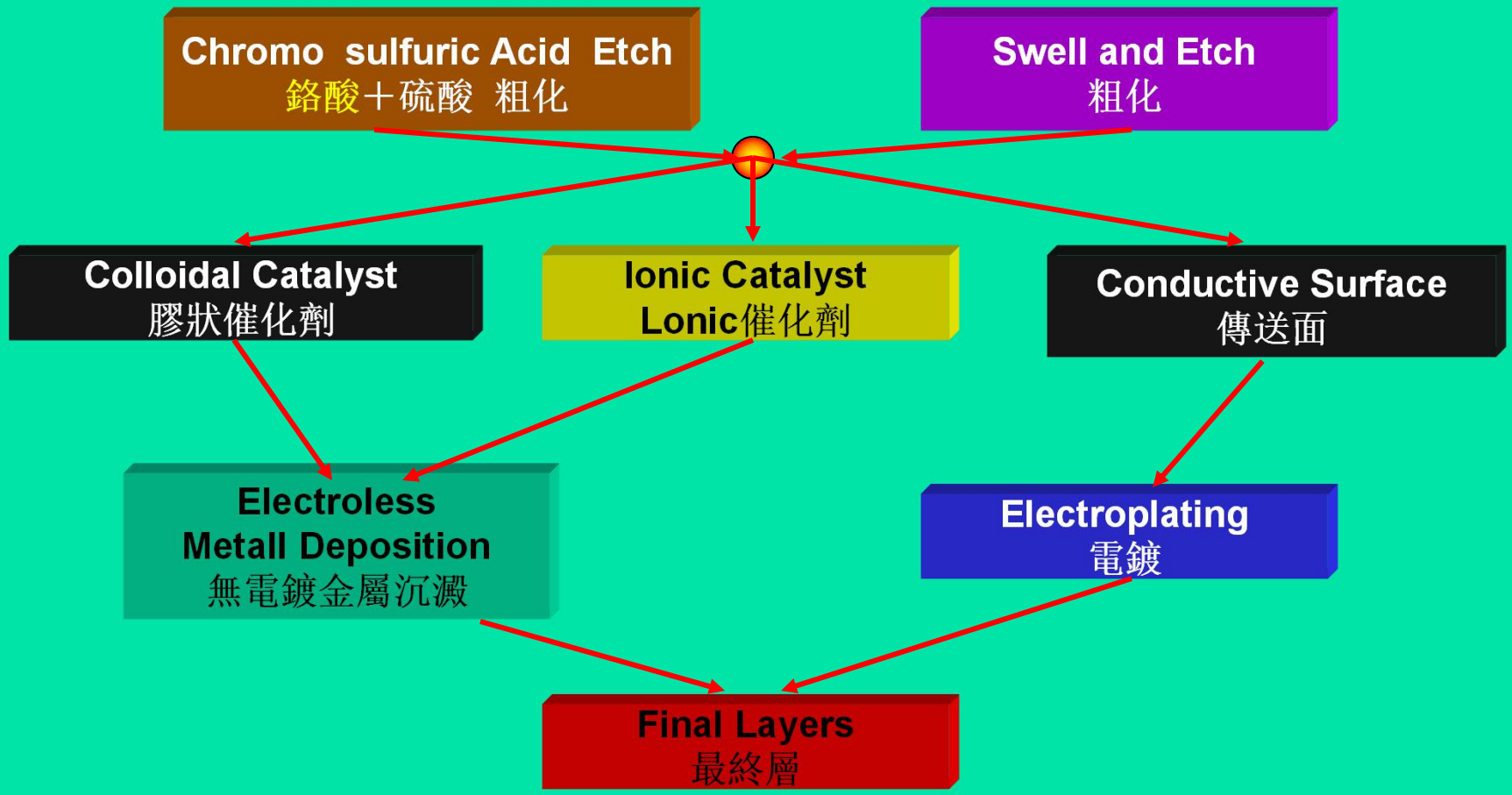
塑膠電鍍介紹Plating on Plastics

Chart of Treatments on Plastic Surface

Item / Method	Electrical Applianc plating	Color plating	Spraying paint in vacuum+UV paint	I.M.D	PU paint	UV paint	PVD TiN ZrN	Print in water
R.C.A	Pass successfully	Pass successfully	p	pass	NG	pass	Pass successfully	NG
Hardness	>9H	5H	3H	4H	2H	3H	>9H	2H
Resistance to solvent	good	good	good	good	NG	good	good	NG
ANTI-UV	good	good	good	pass	pass	pass	pass	NG
Fineness of surface	good	good	average	good	average	average	good	average
Verge coverage	good	good	good	good	good	average	good	average
Evenness of membrane	good	good	average	average	average	average	good	average
Sense about mental	good	good	average	average	average	average	good	average
quality of batch production	average	good	good	good	good	good	average	good
operation	complex	complex	average	average	average	average	complex	average
Electric power function EMI ESD	good	good	Secondary process is necessary	Secondary process is necessary	Secondary process is necessary	Secondary process is necessary	good	secondary process is necessary
Dropping of liquid	YES	NO	Y	Y	Y	Y	N	N
Adhesion of dust	NO	N	Y	Y	Y	Y	NO	Y
Technique norm	HIGH	HIGH	average	average	average	average	high	high
price	average	expensive	average	average	average	average	extremely expensive	average

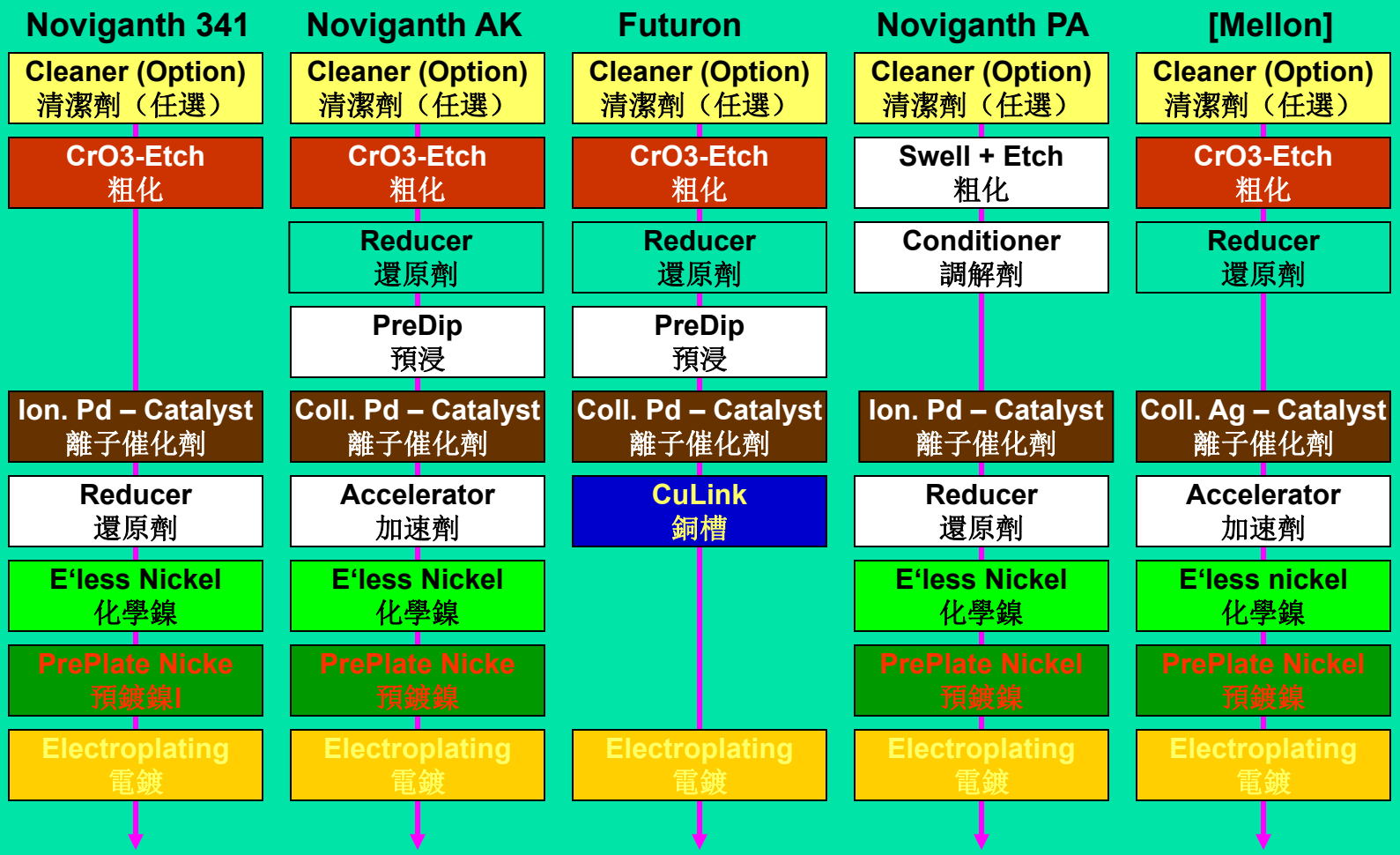
塑膠電鍍介紹　Plating on Plastics

Principle Possibilities　原理



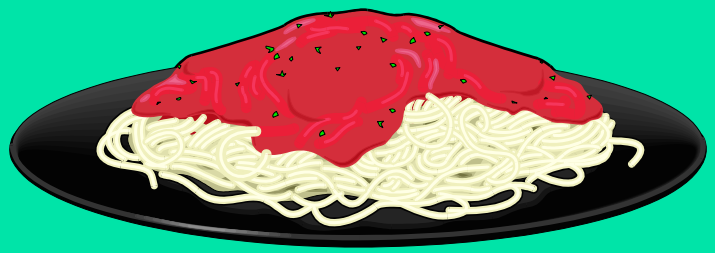
塑膠電鍍介紹Plating on Plastics

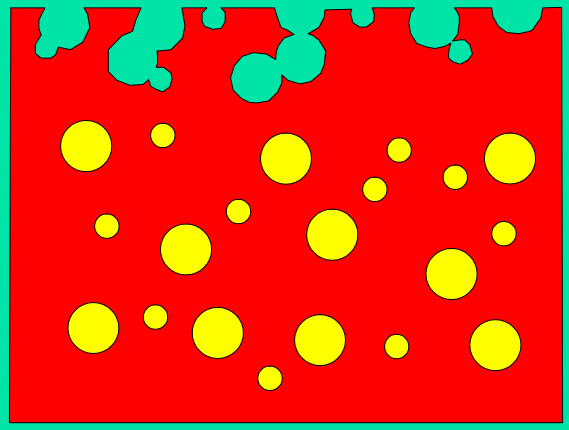
Comparison of Foxconn‘s Processes 制程對比

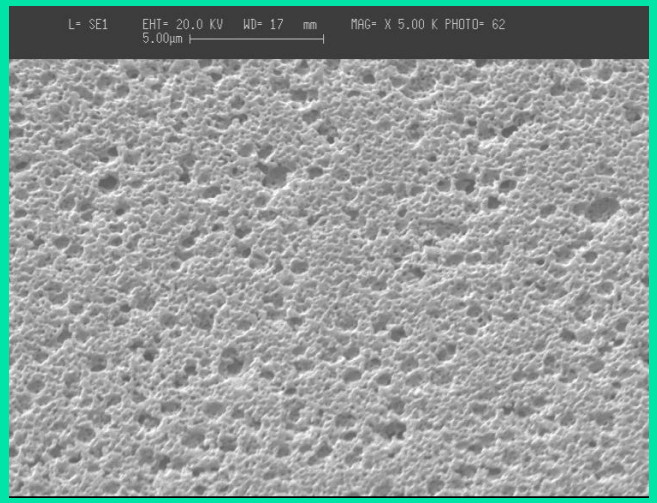


塑膠電鍍介紹　Plating on Plastics

Structure of Polymers on ABS – Basis　ABS表面聚合物結構－基



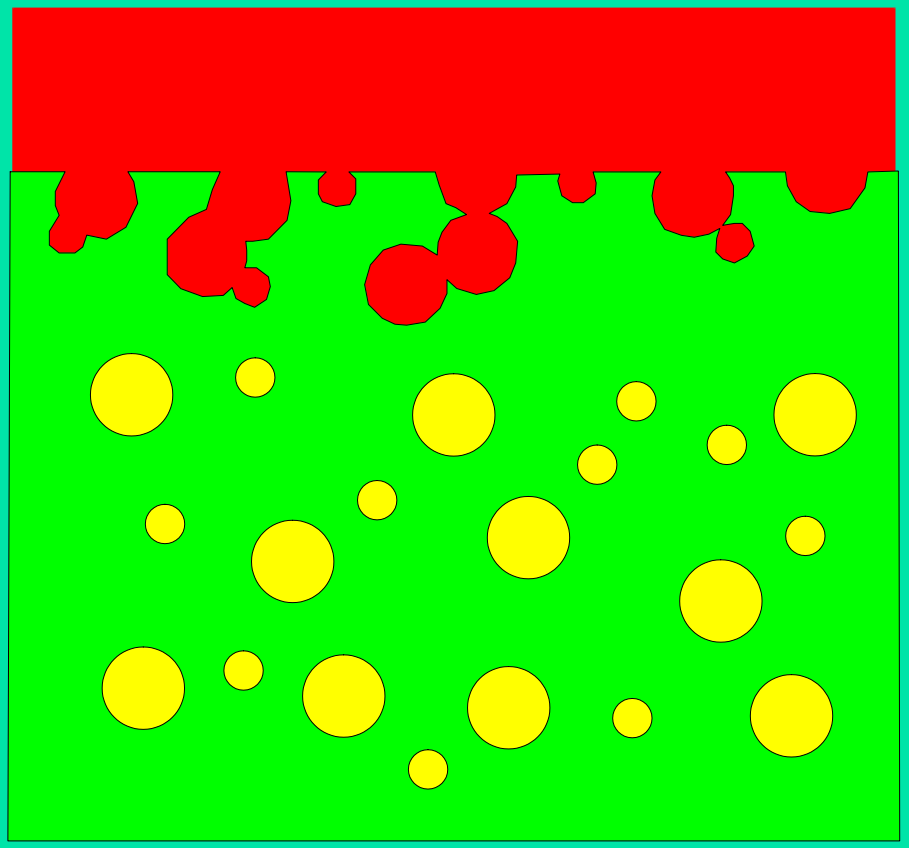




塑膠電鍍介紹　Plating on Plastics

Theory of Adhesion: Mechanical Interconnection

黏合原理　：　自動連接



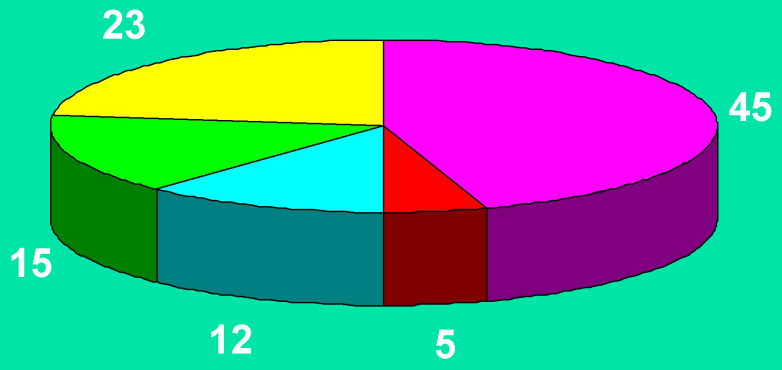
To separate the metal from the plastic, energy must be applied to compensate the cohesive forces in the plastic matrix (green) or in the metal (red).

為將金屬從塑膠中分離出來，必須要求有能夠同塑膠母体（綠色）和金屬（紅色）的能量相抵之能量．

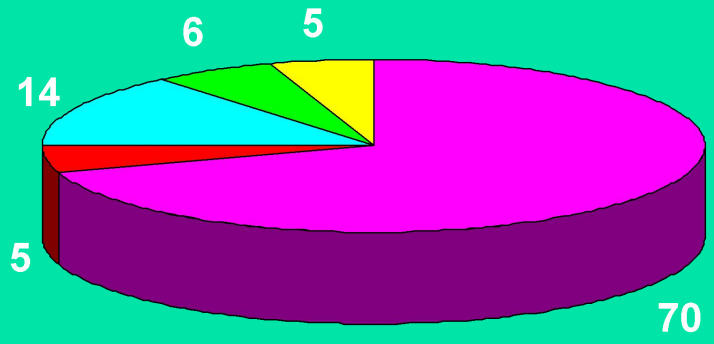
塑膠電鍍介紹 Plating on Plastics

Typical „Polycarbonate“ Blends 典型“多碳酸鹽”混合

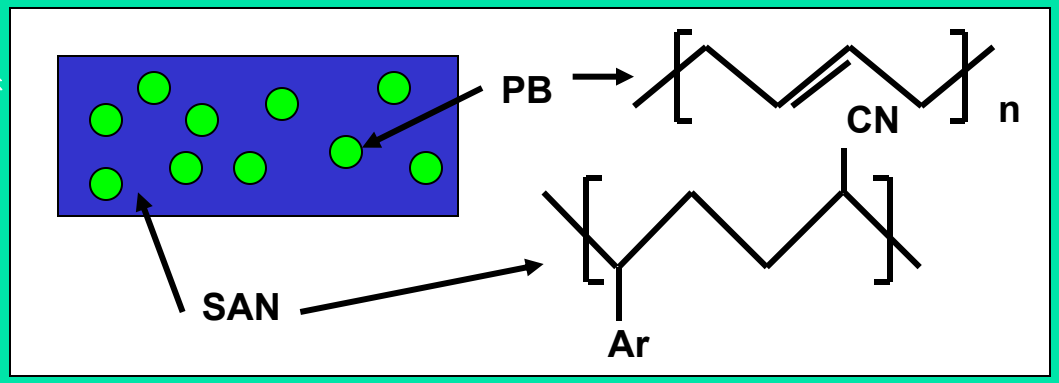
Bayblend T45



Bayblend FR1441



- Polycarbonate 聚碳酸鹽
- Polyacrylonitrile 聚丙烯腈
- Polystyrene 聚苯乙烯
- Polybutadiene 聚丁二烯
- Filler, Pigments,...填充料 顏料



塑膠電鍍介紹 Plating on Plastics

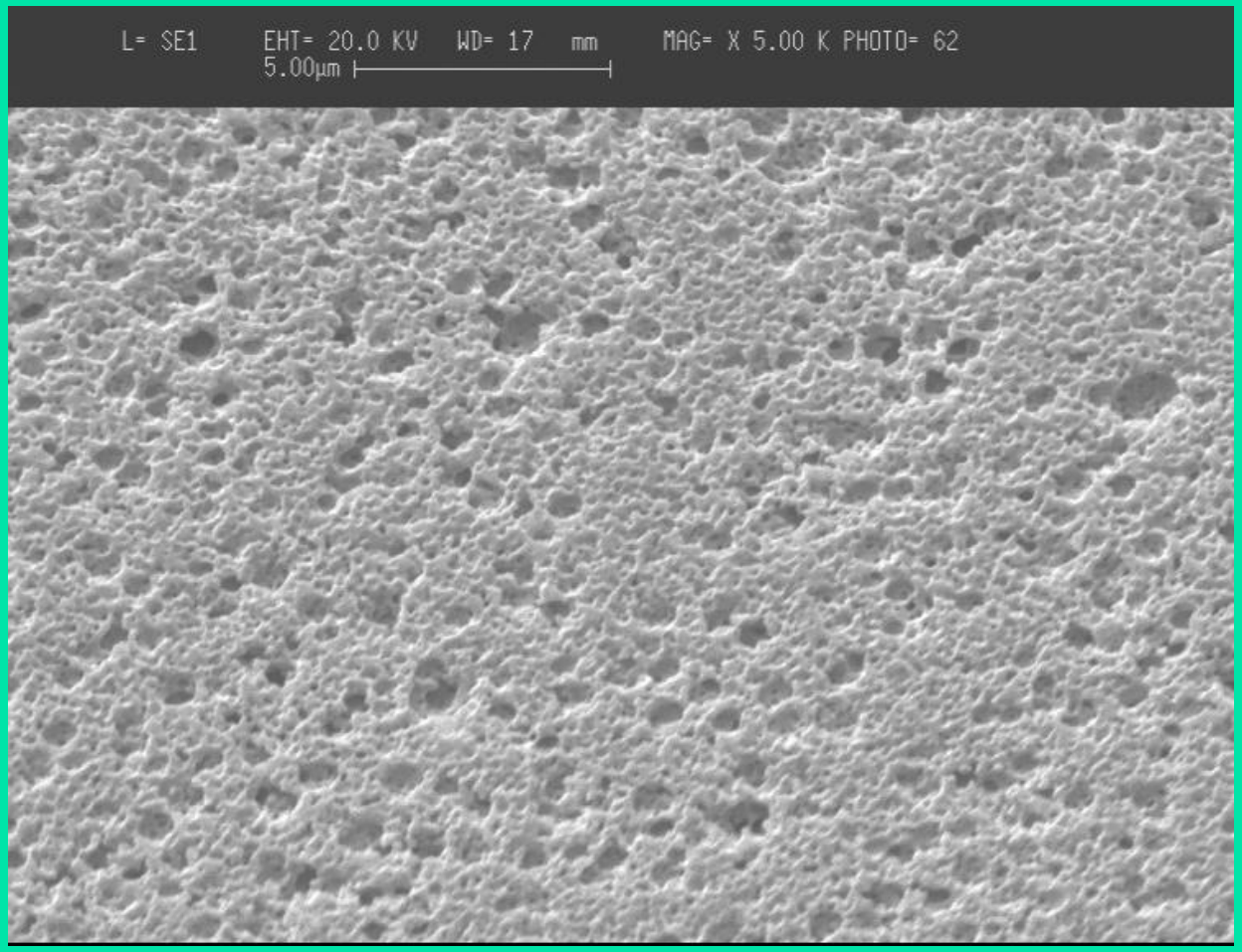
Some Plateable Grade Plastics 可電鍍塑膠

Typ 類型	Name 名稱	Supplier 供應商
ABS	Novodur P2MC, PM3C Cycolac Lustran PG299 Ronfalin CP55	Bayer AG General Electrics Monsanto DSM
ABS + PC	Bayblend T45 Cycoloy	Bayer AG General Electrics
PPO	Noryl PN235	General Electrics
PP	Codyx 4019G	RTP
PA	Durethan BM240 Minlon 73M40 Ultramid B3M6 IXEF	Bayer AG DuPont BASF Solvay
LCP	Vectra	Hoechst AG
TPO	RD P98119	Solvay

塑膠電鍍介紹　Plating on Plastics

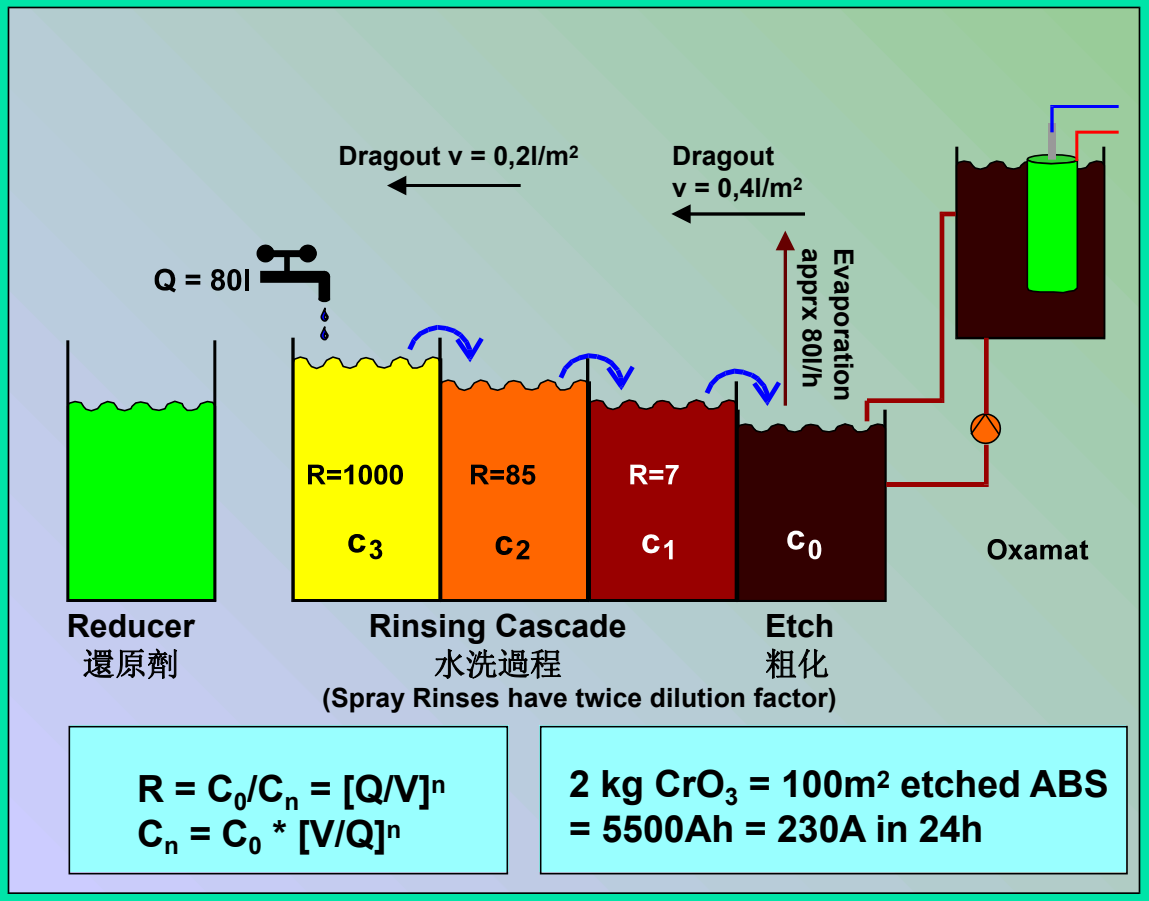
Perfectly Pretreated ABS Surface (SEM, 5000x)

完全粗化處理之ABS表面 （SEM，5000x）



塑膠電鍍介紹 Plating on Plastics

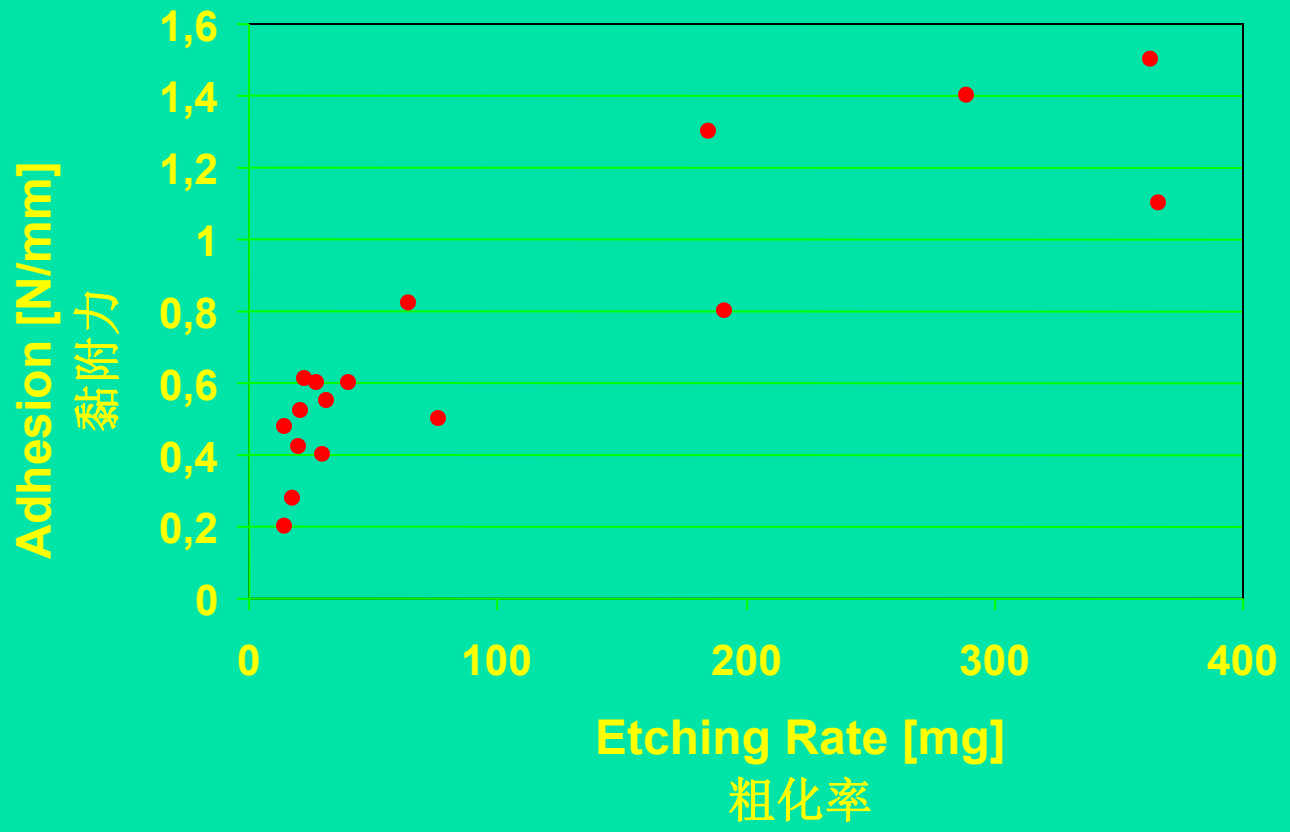
Rinsing: Concept
水　洗 ： 步驟



塑膠電鍍介紹 Plating on Plastics

Etching Rates of Bayblend (25cm²) and Resulting Adhesion of Plated Metal Layer.

Bayblend (25cm²)粗化率及電鍍后之金屬面所產生的黏附力．



etchrough0

塑膠電鍍介紹 Plating on Plastics

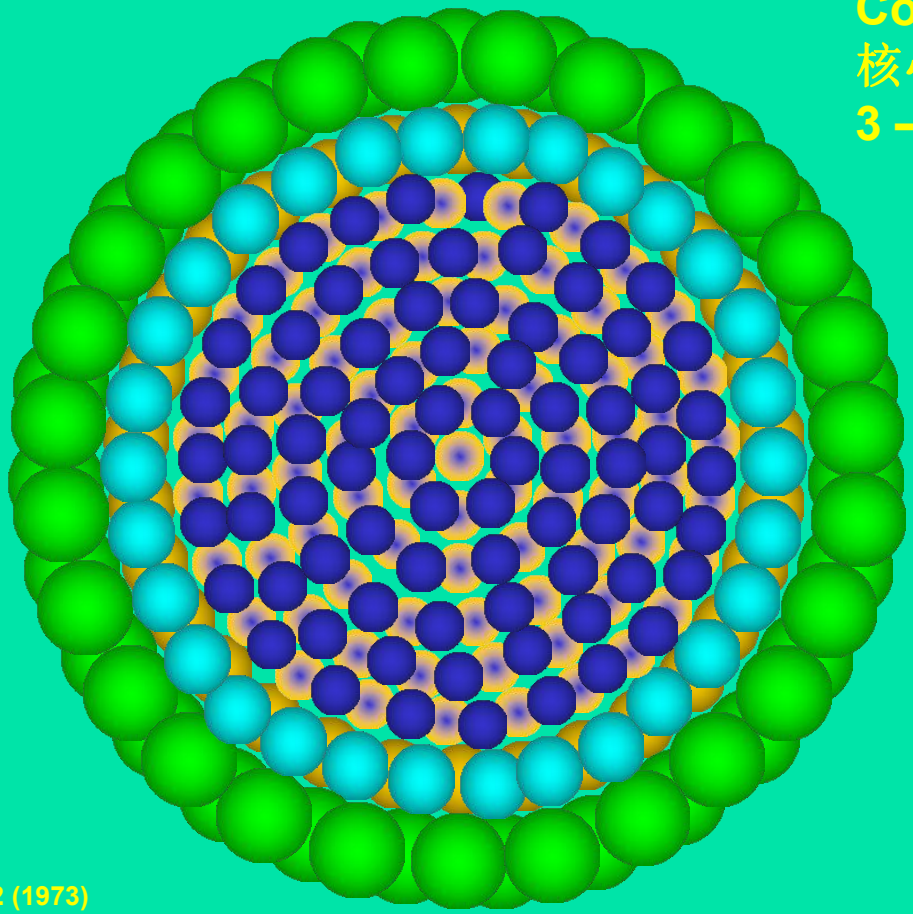
Palladium / Tin Cluster 鈀 / 錫簇

Cl⁻ 0,181nm

Pd 0,128nm

Sn^{2+} 0,093nm

Sn



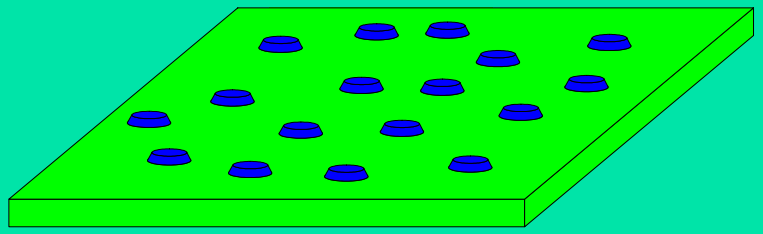
Core Diameter:
核心直徑
3 – 4nm

R.L.Cohen K.W.West
J.Electrochem.Soc. 120, 502 (1973)

cluste10

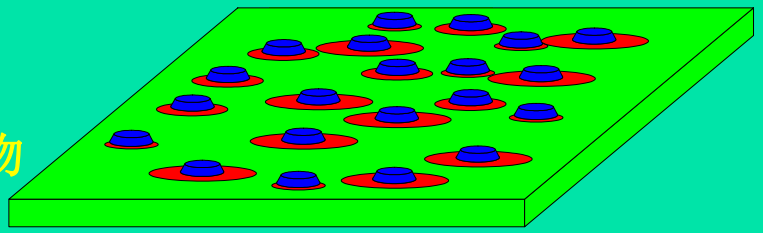
塑膠電鍍介紹　Plating on Plastics

Electroless Metal Deposition (Model) 化學金屬沉澱物

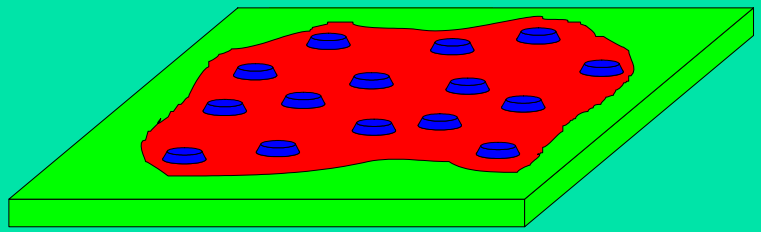


Active plastic‘s surface
活性塑膠表面

Start of metal-deposition.
開始出現金屬沉澱物



Complete metalization: all activator particles are connected electrically conductive.
金屬化完成： 所有活性劑顆粒均結合在一起具導電性．



塑膠電鍍介紹 Plating on Plastics

Electroless Nickel Deposition I 化學鎳沉澱物 I

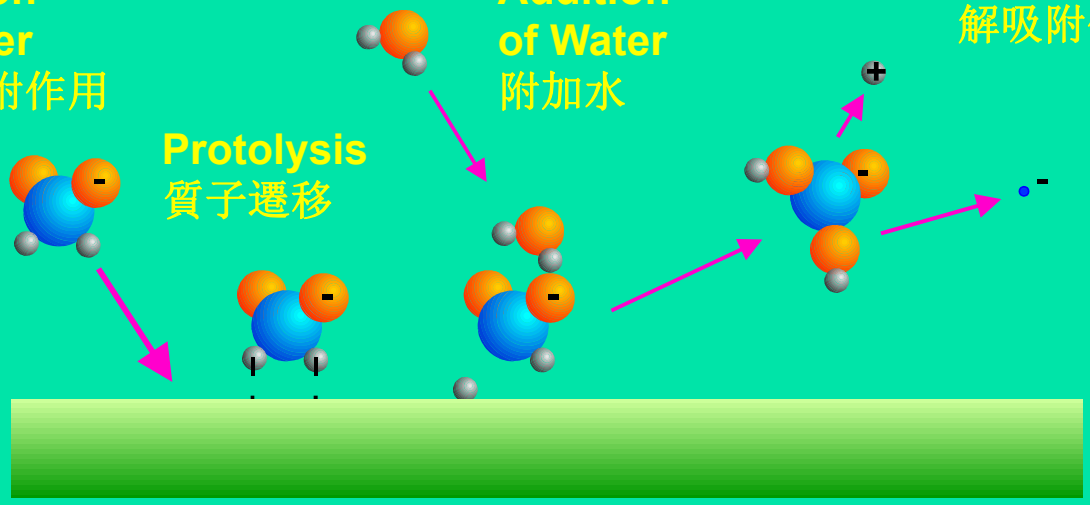
Starting Reaction
初期反應

Adsorption of Reducer
還原劑吸附作用

Protolysis
質子遷移

Addition of Water
附加水

Desorption
解吸附作用



塑膠電鍍介紹 Plating on Plastics

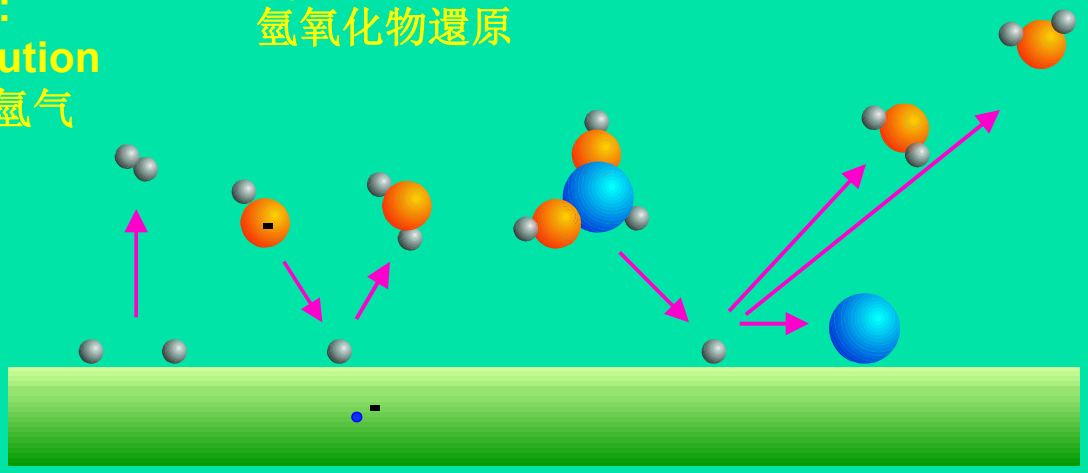
Electroless Nickel Deposition II 化學鎳成份 II

Side Reactions
側邊反應

Recombination of Hydrogen Atoms: Hydrogen Gas Evolution
氫原子再結合：成為氫气

‚Reduction' of Hydroxide
氫氧化物還原

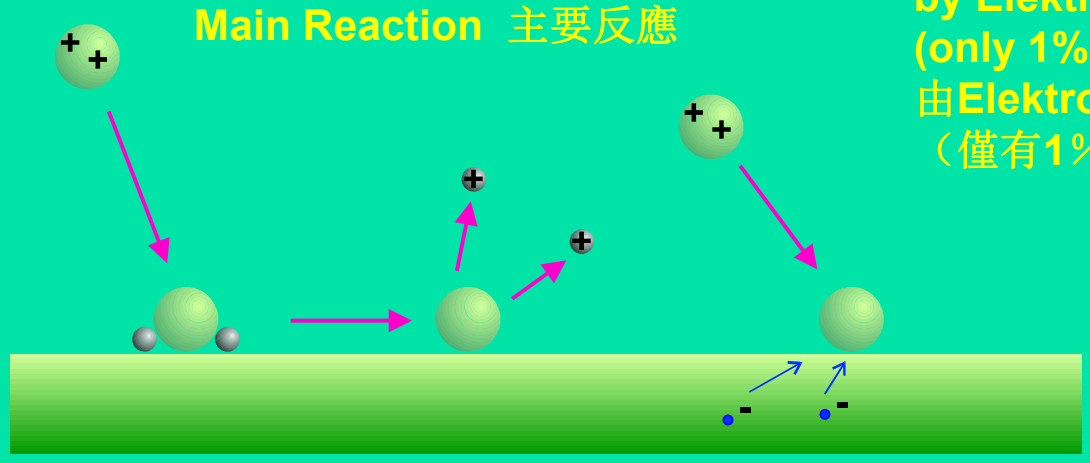
Phosphorous-Co Deposition
磷酸根 沉澱物



塑膠電鍍介紹　Plating on Plastics

Electroless Nickel Deposition III
化學鎳成份 III

Metal Deposition 金屬沉澱物

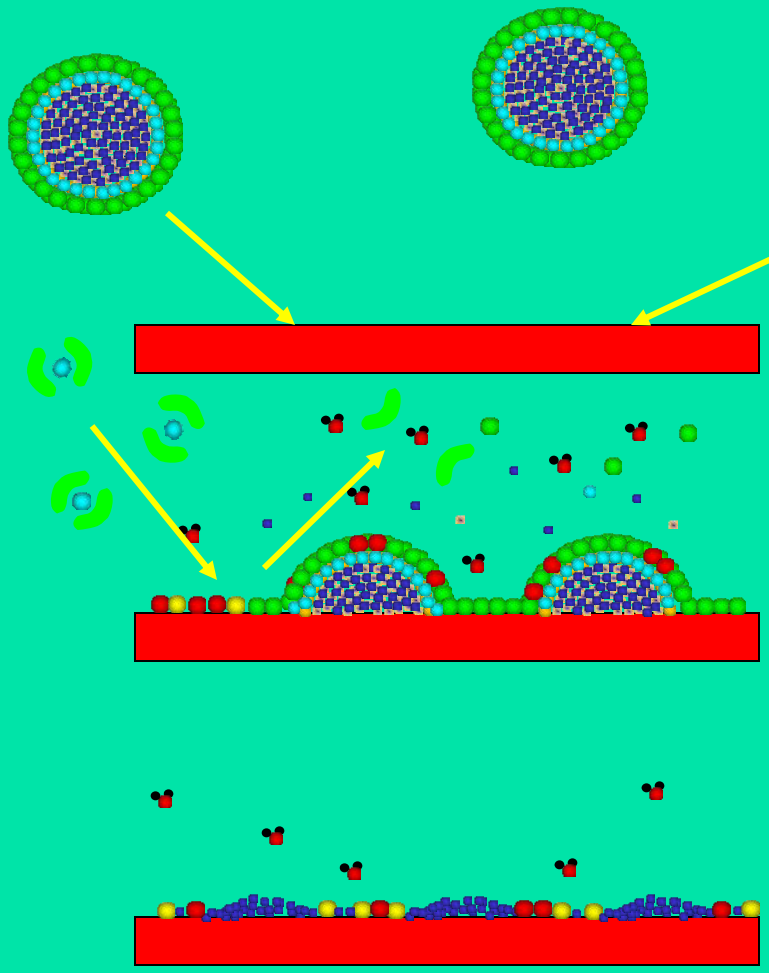


Direct Reduction by Elektrons (only 1%)
由Elektrons直接還原（僅有1%）

塑膠電鍍介紹　Plating on Plastics

Mechanism of the CuLink – Operation (Model)

銅槽機能－操作（模型）



Activator particles are bound to a plastic‘s surface.

活化劑顆粒同塑膠件表面結合

Chelated copper ions are reduced to either copper(0) or copper(I) by tin.

螯合銅離子被錫還原成為銅（0）或銅（1）．

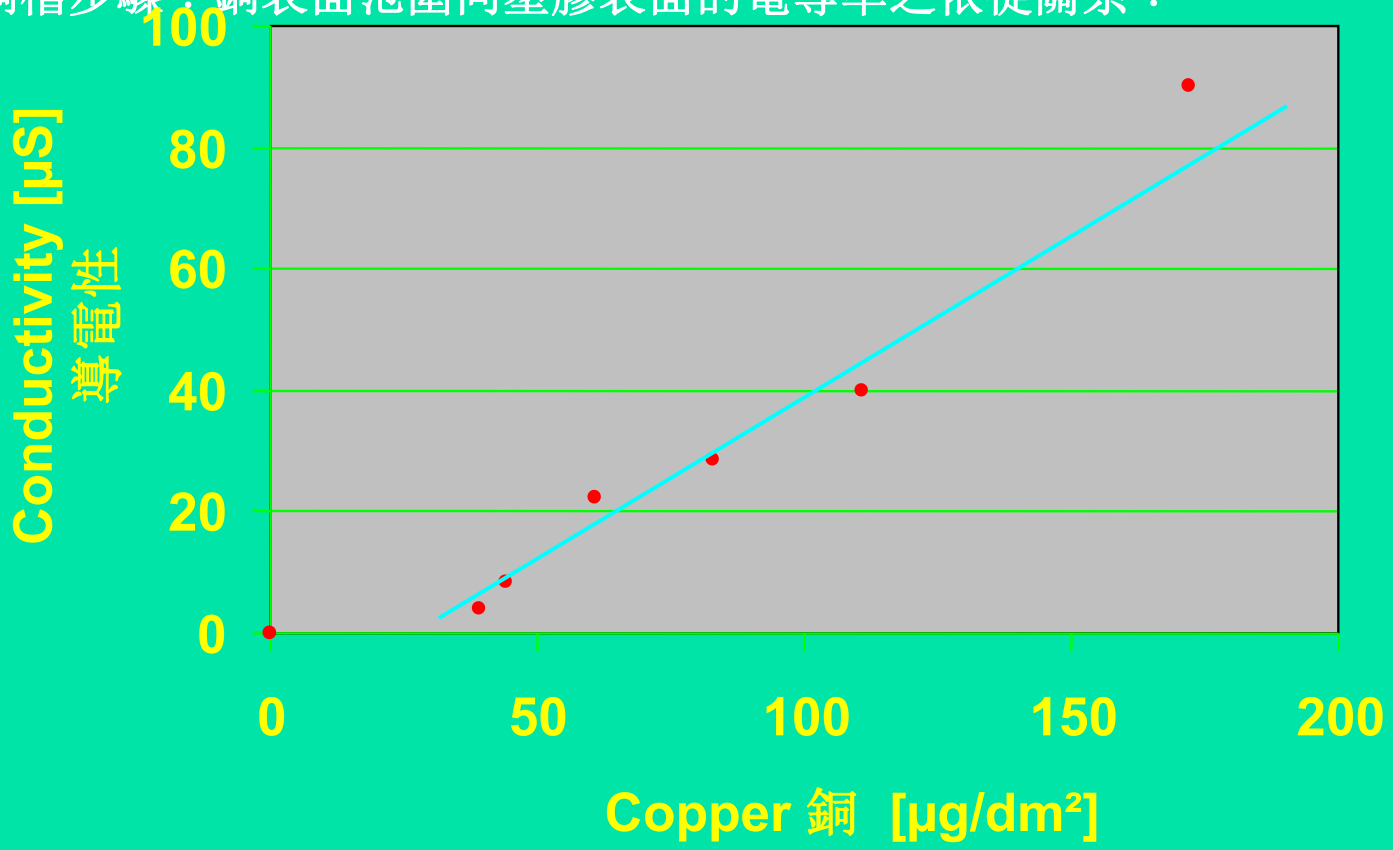
The copper crosslinks the palladium particles resulting in a electroconductive surface layer.

銅与鈀顆粒交叉結合形成一個導電表層．

塑膠電鍍介紹 Plating on Plastics

CuLink-Step: Dependence of the Electrical Conductivity of a Plastic‘s Surface from Surface Bound Amount of Copper.

銅槽步驟：銅表面范圍同塑膠表面的電導率之依從關系．



塑膠電鍍介紹 Plating on Plastics

Simplified Model of the Spreading of Metal during Plating after the CuLink Step 在完成銅槽步驟后，電鍍中金屬擴散的簡單模擬圖．

Palladium cluster are crosslinked by copper or by copper ions.
鈀簇由銅或銅離子相交聯構成．
During electroplating, copper ions are reduced to copper 在電鍍的過程中，銅離子將被還原成銅 .