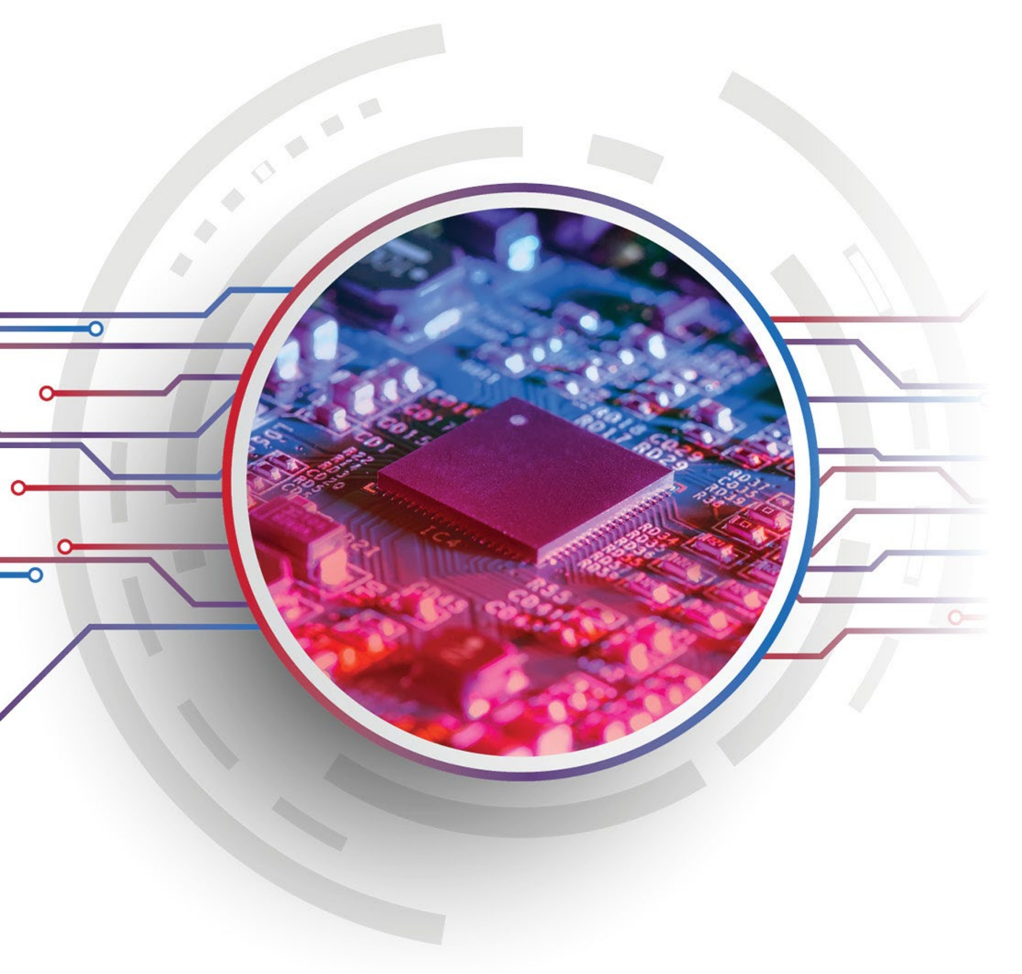


MID Technologies
MID技术

Innovative Plating Solutions for LDS MIDs
创新的LDS MID电镀液

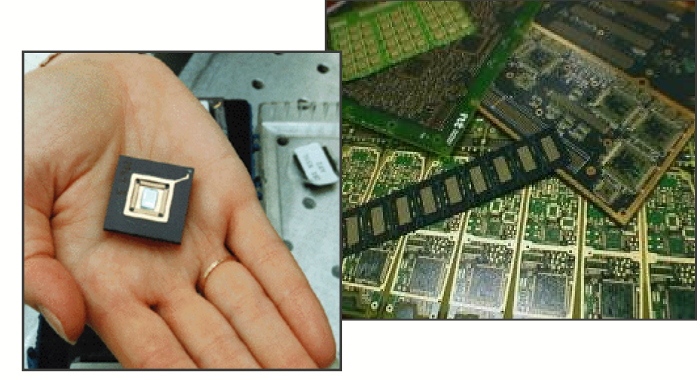
Judy Ding & Boen Li
丁颖 &李博恩

MacDermid Alpha Electronics Solutions

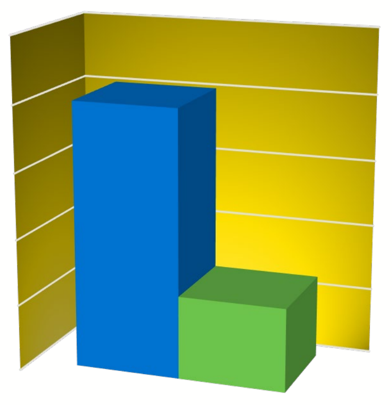
- Over 2000 Worldwide Employees in 23 Countries 遍及23个国家有超过2000名员工
- Over 3500 Customers Served Worldwide by Direct Sales/Service Organizations 全球直接销售/服务3500客户
- Regional Centers of Expertise 区域专业中心

Industrial Solutions 工业药水

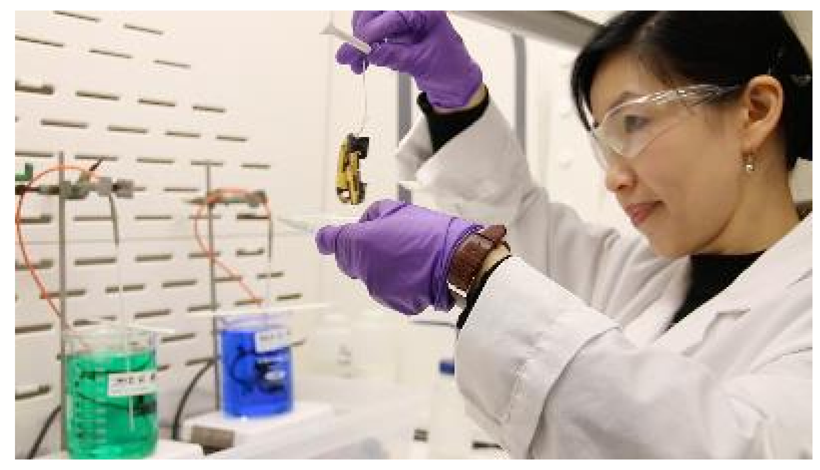
Electronics Solutions 电子药水

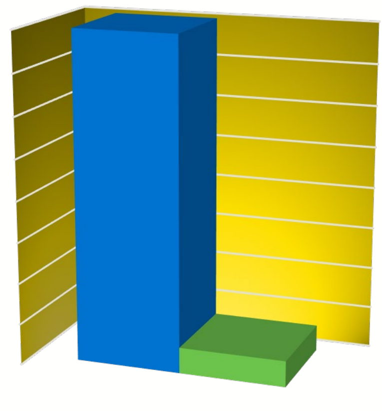


Our Commitment to Technology
致力于技术开发



- 2014 EBITDA
- 2014 R&D Investment





- 2014 Revenue
- 2014 R&D Investment

In 2014, We spent an industry-leading **7.8%** of our revenue on R&D

在2014年，我们收入的7.8 %在研发上，是业界领先的技术

Electronics Solutions Enabling Technology
电子药水的使能技术

Worldwide Coverage全球覆盖

Europe

Americas

Asia-Pacific

- Our regions of MID expertise
- 的区域MID技术中心

MID Piloting Capabilities in Technical Center
MID在技术中心的试点能力

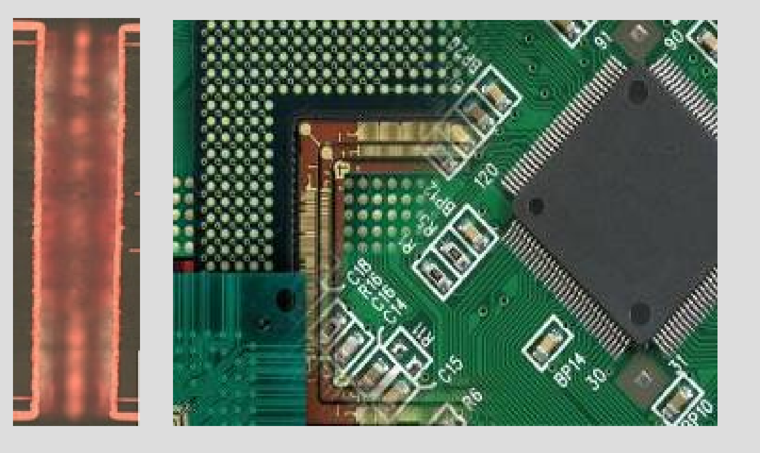
MacDermid Enthone

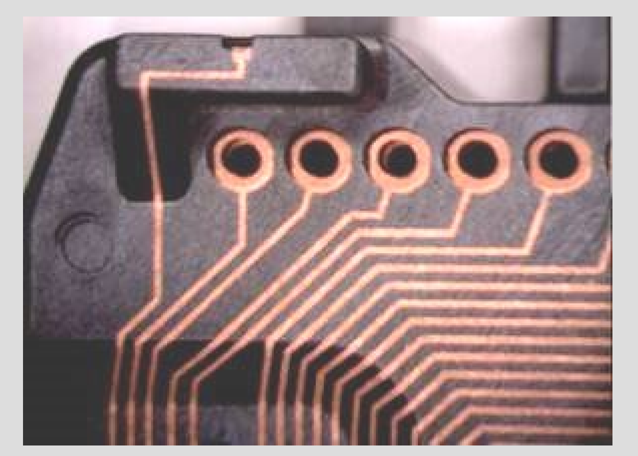
- Modern, clean, and well-equipped facility serving as “proof source” for MacDermid global research and as key demonstration site for key customers and OEMs. 现代化、清洁、设备齐全的设施作为“工艺确认”，我们的全球研究和作为重点客户和OEM厂商的示范。
- Small scale (40 liter) barrel piloting dedicated to electroless copper MID plating enables fast confirmation of developments combined with close to real-world loading and plating Conditions 小规模（40升）桶试点致力于化学镀铜MID电镀的快速认证，开发和现实世界 结合紧密的装载和电镀条件

MID Metallization Solutions
MID金属化药水

Plating on Plastics Used for Decorative and Functional coatings 用于装饰与功能性涂料的塑料电镀

Electroless Copper for Electronics 电子化学镀铜





A combined expertise in POP and electronics plating applications remain crucial in the development and optimization of MID plating processes. POP和电子电镀综合技能对于MID电镀工艺的开发和优化很关键。

- A "Merger" of Surface Finishing Innovations 表面精加工创新的"合并"

MID Technology MID技术

- Molded Interconnect Device (MID)
  - Defined as an injection molded thermoplastic substrate which incorporates a conductive circuit pattern 定义为注塑成型的热塑性塑料基体结合了导电电路图案
    - integrating mechanical and electrical functions结合机械和电气功能
- Today's Market 现今的市场
  - Growth in MID is a result of advances in plastic materials, the development of Laser Direct Structuring (LDS) and plating process availability. MID增长是塑料材料、激光直接成型和电镀工艺发展进步的结果（LDS）
    - Majority of production volume still remains in antennas for mobile communication devices including mobile phones, laptops, tablets, etc.
    - 大部分生产量仍停留在天线的移动通信设备，包括移动电话，笔记本电脑，平板电脑，等等。
- Growth opportunities in additional markets在其他市场的成长机会
    - Automotive, medical, lighting, consumer goods汽车，医疗，照明，消费品
    - Opens up capabilities in design and function 开辟了在设计和功能的能力
    - New options for miniaturization for form and fit 小型化的外形和和装配

Industry Drivers and Trends
工业驱动和趋势

- Fine Pitch Technology 细线间距技术
  - Opens design capabilities 开阔设计能力
  - Miniaturization 微型化
- SMT Capability SMT能力
  - Reflow resistant plastics 耐回流焊塑料
  - Solderable surface finishes 可焊镀层
- Wire bond capability 打线能力
  - Proper choice of plastics, plating thickness, surface roughness and final finish 适当选择的塑料，电镀的厚度，表面粗糙度和最终镀层
- Lighter design 轻量化设计
  - Integrating circuitry with existing part to reduce number of components 集成电路与现有的部分，以减少部件的数目
- Power and Style 电源和造型
  - Integrating circuitry to provide opportunities for future designs 集成的电路来提供未来的设计机会

Copper Innovations
镀铜液的创新

COPPER INNOVATIONS

- Improved surface roughness 改善表面粗糙度
  - MID Copper X1 process MID铜X1
  - Better surface appearance, smoother deposit 更好的表面外观，平整的镀层
  - Improved SMT and wire bond performance 改进SMT和引线键合性能
- Fast plating speed 快速电镀
  - MID Copper 100 XD process MID铜100 XD
  - 50% reduction in plating time 电镀时间减少50 %
- Improved Adhesion to emerging plastics 改进新兴塑料的结合力
  - MID Copper 100 XD process MID铜100 XD制程
  - Enhanced adhesion to PC substrates 增强于PC基材的结合力
- Improved manufacturing plating process 改进的电镀工艺
  - MID Copper 100 XB process MID铜100 XB制程
  - Optimized plating capability on LDS substrates 优化在LDS基材的电镀能力
  - Initiation, stability = high yields, lower cost 触发快，稳定 = 产量高，成本低

Improved manufacturing performance
改善生产性能

- MID Copper 100 XB process provided industry with MID铜100 XB为行业提供
  - A novel Strike copper process 一种新型的冲击铜工艺
    - Complete uniform initiation on LDS substrates LDS 基材的均匀覆盖
    - Consistent predictable plating rates 一致的电镀率
    - Stable process chemistry, long bath life 稳定的工艺化学，槽液寿命长
    - Eliminated skip plating issues 消除漏镀问题
- A novel Build copper process一种新型的沉厚铜工艺
    - Consistent predictable plating rates 一致的电镀率
    - Stable process chemistry, long bath life 稳定的工艺化学，槽液寿命长
    - Eliminated overplating (extraneous) issues 消除溢镀（毛边）的问题
    - Fully analyzable stabilizer package 可分析的稳定剂

MID Copper 100 XB - Key MID Plating Priorities
MID铜100 XB - 关键MID电镀重点

Common issues effecting manufacturing yields
影响生产良率的常见问题

Skip plating 漏镀

Overplating 溢镀

Tank plateout 槽液析出

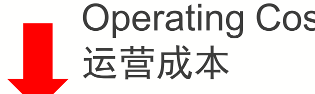
Development 开发

Results 成果

Yields
产率

Productivity
生产效率

Ease of Use
易用性



Operating Cost
运营成本

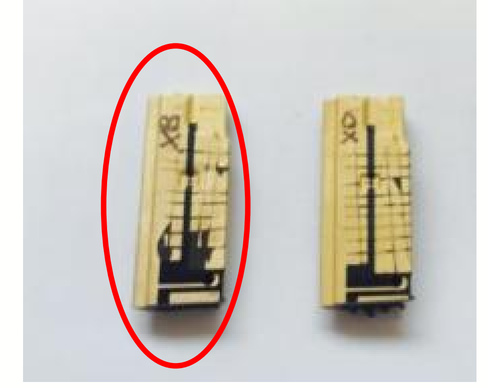
Improved Adhesion 更好的结合力

- MID manufacturers began to migrate from PC/ABS to PC substrates. MID厂商开始从PC/ABS材料迁移到PC基材。
- PC (polycarbonate) substrates offer improved impact resistance. PC(聚碳酸酯)基材改进耐冲击性能。
- Challenges with adhesion of the plated deposit began to be reported. 与镀层的结合力面临挑战。
- MID Copper 100 XD process developed to provide improved adhesion to PC MID substrates MID铜100 XD的开发专为PC MID基材提供更好的结合力。

XB Sample XB样品

Cu grain structure after peroxide etch.

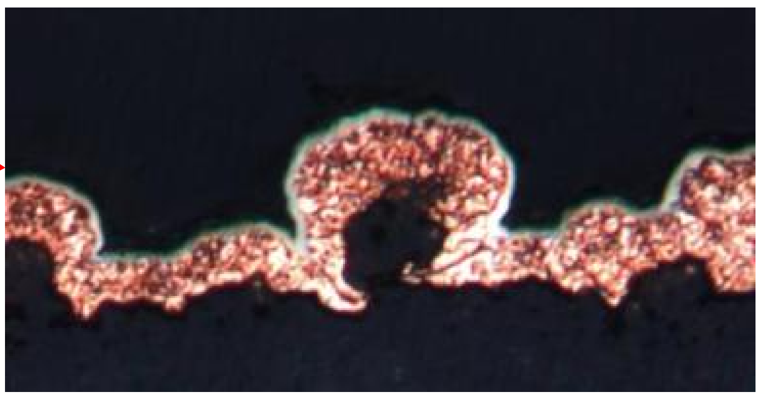
Light Adjusted for Plastic



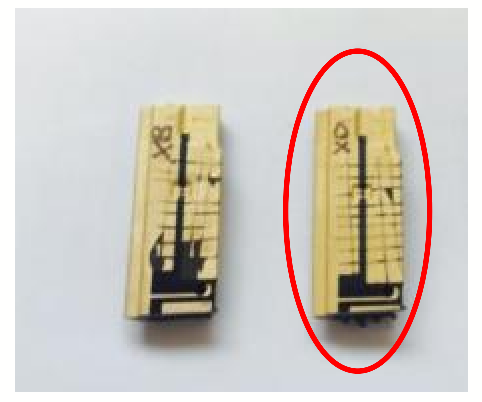
- Note delamination within PC substrate due to plating chemical attack. 由于电镀化学的侵蚀，在PC基材内出现剥离。
- Associated with failed tape testing. 导致胶带测试的失败。

XD Sample XD样品

Cu grain structure after peroxide etch.

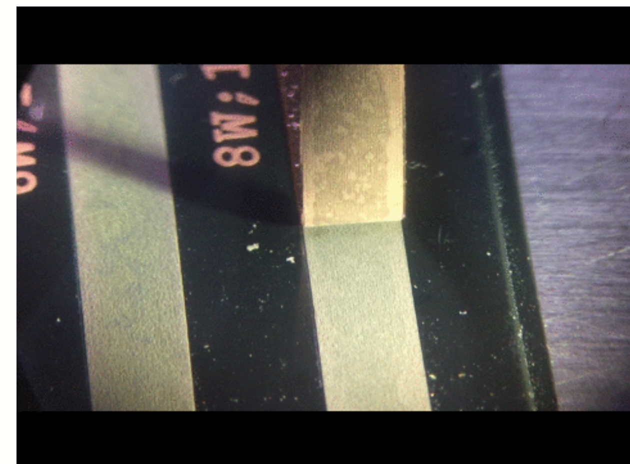


Light Adjusted for Plastic

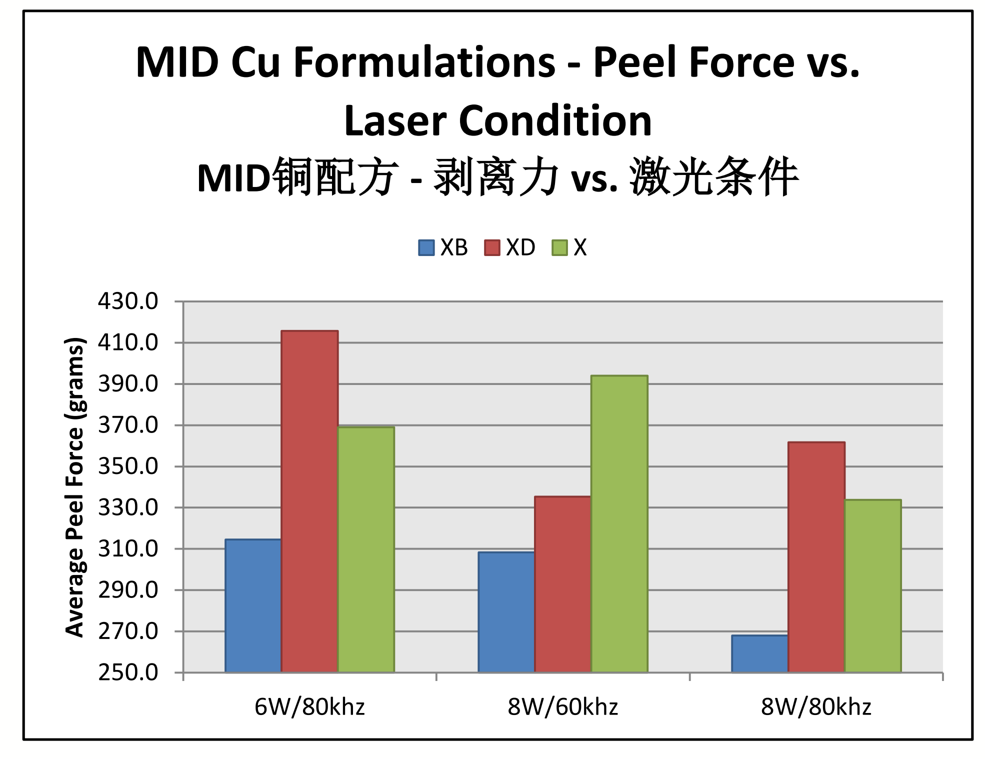


- No visible signs of delamination within LDS PC substrate. PC基材内没有明显的内分层迹象。
- Improved adhesion verified by industry standard tape testing. 行业标准的胶带测试验证了改善的结合力。

Improved Adhesion 改善结合力



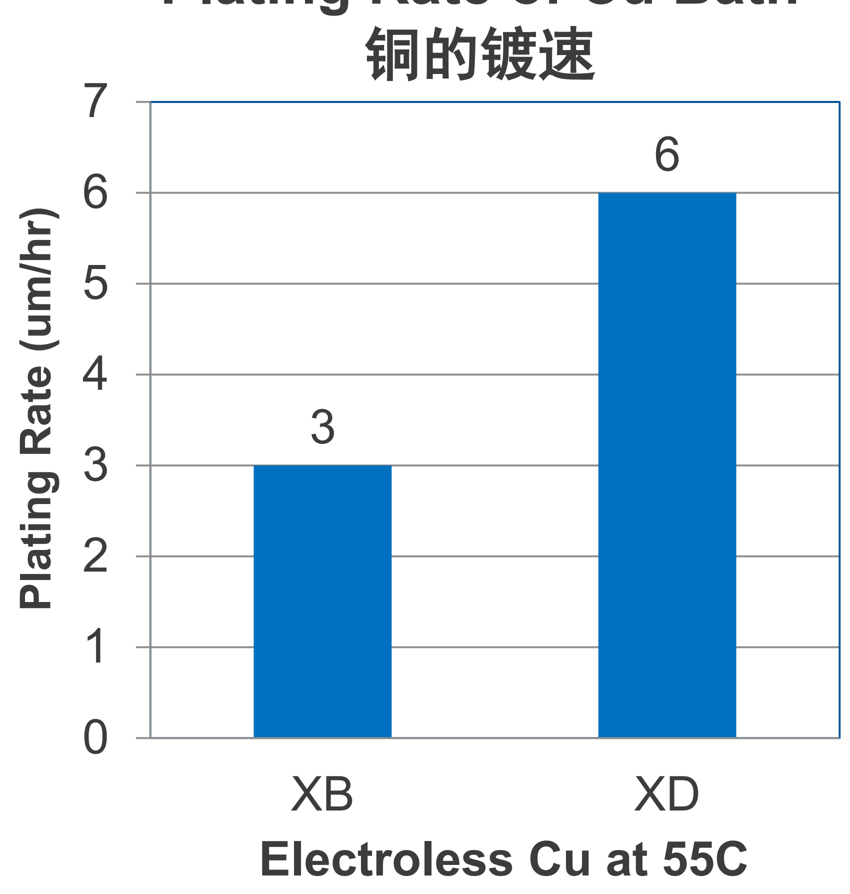
Digital Peel Test – XYZTEC Condor



- Adhesion of electroless Cu is quantitatively tested using a highly sensitive digital pull apparatus. 铜的结合力可以使用一个高度敏感的电子数显拉力装置定量检测。
- MID XD and X1 copper have improved adhesion on PC plastics with all commonly utilized laser structuring powers. MID XD和X1铜改善对PC塑料的结合力

Improved Speed 提高速度

- Responding to demands for increase throughput.响应对提高产量的需求
- MID Copper XD process doubled the plating speed without negative impact on stability or bath life. MID铜XD电镀速度提高一倍，不影响溶液稳定性或漕液寿命。
- Further increase production output without negative impact on quality.进一步提高产量，不影响质量。
- Lower overall running cost by maintaining stability and high speed.通过保持稳定性和高速性降低整体运行成本。

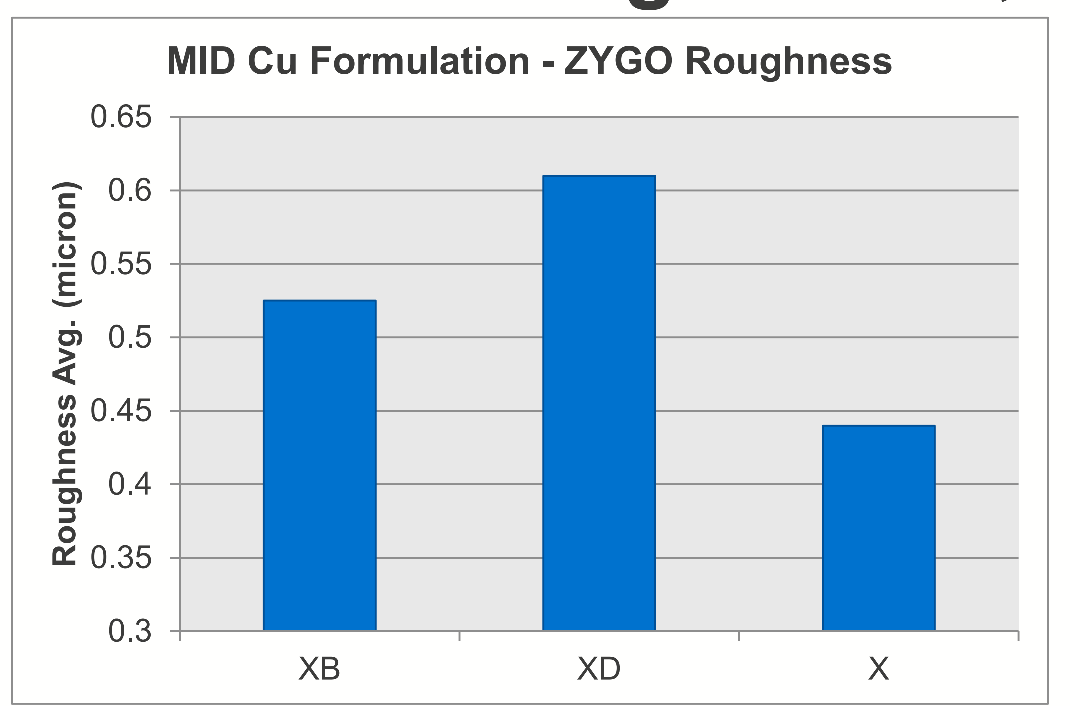


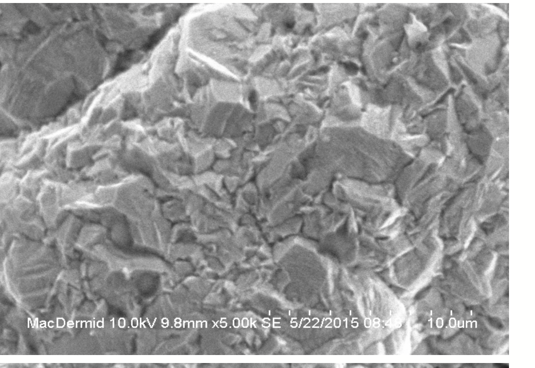
Improving Surface Roughness
改善表面粗糙度

- Surface roughness can be a challenge as MIDs are used in new applications. 表面粗糙度可以是MID的新应用的一个挑战
- Roughness of the plated deposit may affect SMT and wire bonding requirements. 镀层粗糙度会影响表面贴装和引线键合的要求。
- Plated deposit roughness is linked to the roughness of the activated plastic. 镀层粗糙度与活化塑料的粗糙度有关
- LDS surfaces are rougher than DS surfaces LDS表面比DS表面粗糙
- MID Copper X1 process provides a smoother, fine grain, and “shiny” copper deposit MID铜X1提供了一个平滑的，细晶的“闪亮”铜层。

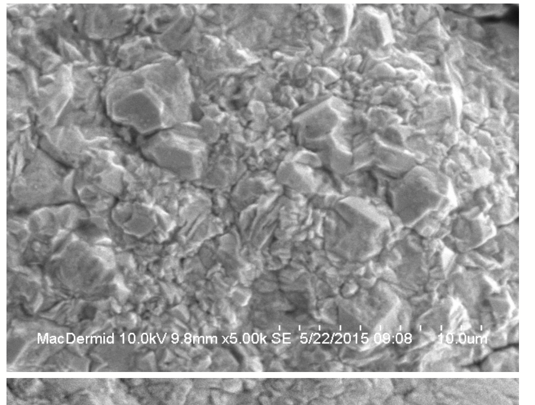
Improved Surface Roughness 改善表面粗糙度

MacDermid Enthone

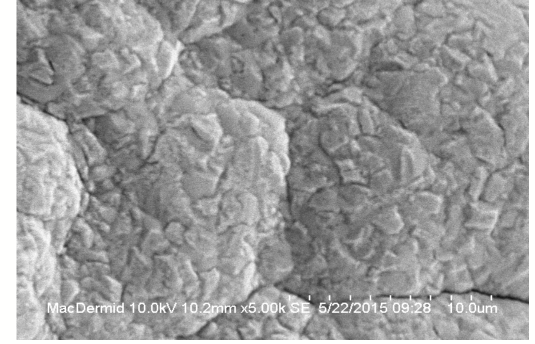




XB

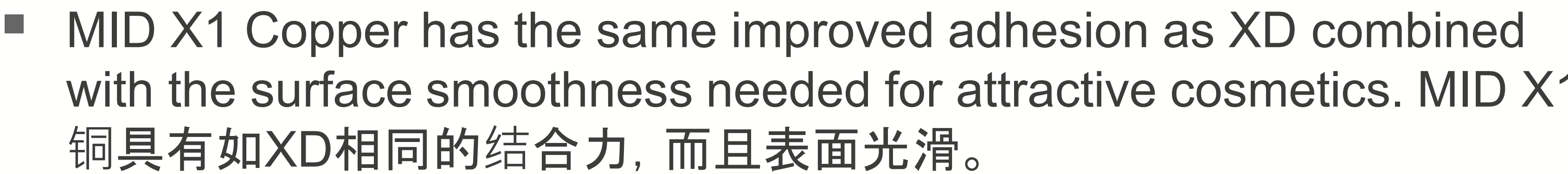


XD



X1

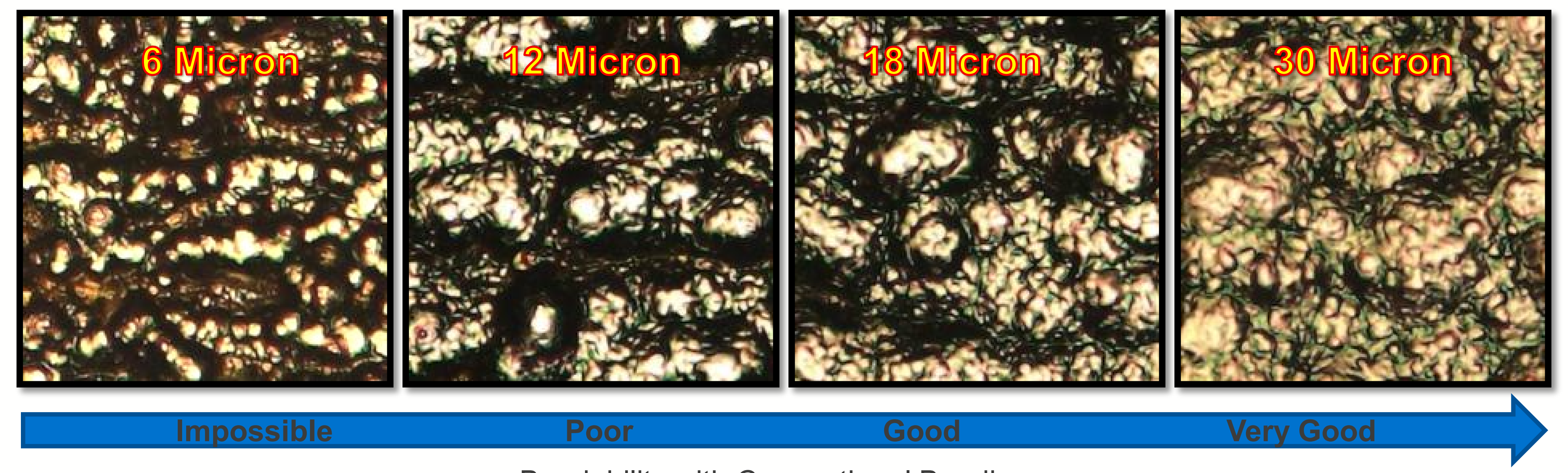
- MID X1 Copper has a lower surface roughness than previous MID Cu formulations. MID X1铜具有比以前的MID铜配方较低的表面粗糙度。



- MID X1 Copper has the same improved adhesion as XD combined with the surface smoothness needed for attractive cosmetics. MID X1铜具有如XD相同的结合力，而且表面光滑。

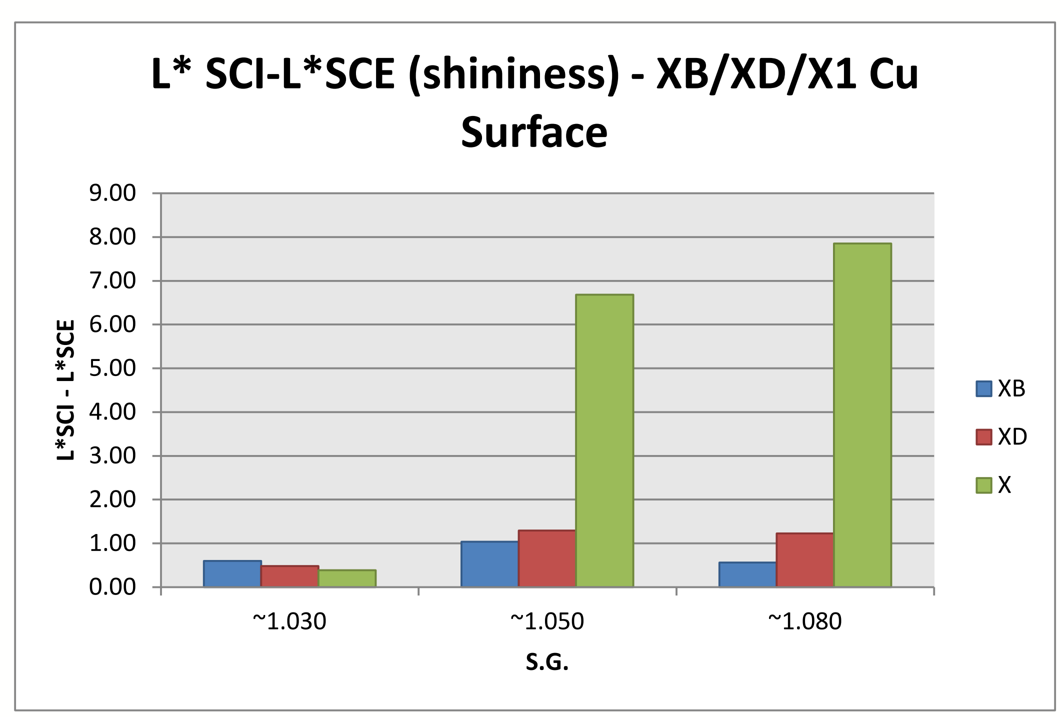
Benefit of Improved Surface Roughness
改进的表面粗糙度的好处

MacDermid Enthone



- Optical microscope shows the surface gets visibly smoother as Cu thickness increases. 光学显微镜显示铜厚度增加,表面变得明显更光滑。
- Conventional wire bonding improves with smoothness. 表面越光滑，打线力提高。

Improved Surface Reflectivity
更好的表面反射率



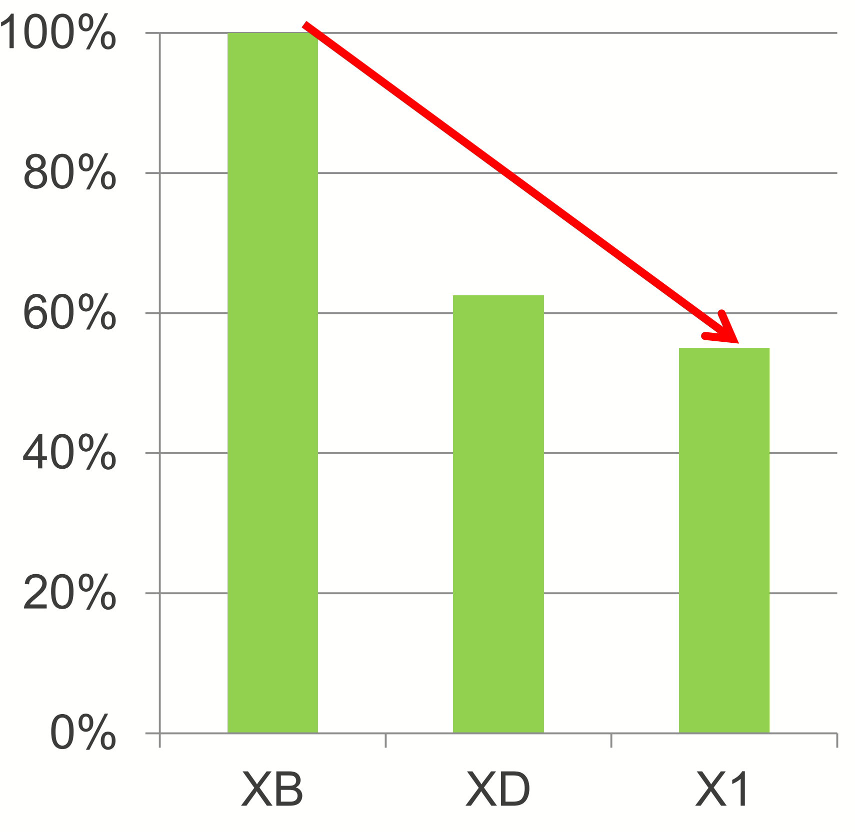
Konica Minolta CM-2600d Spectrophotometer

- MID X-Copper has improved glossy surface appearance vs. older formulations.
  MID的X铜对表面外观有所改善，光泽优于旧配方

Improved Running Cost
改善操作成本

MacDermid Enthone

- Continuous product development leading to reduced running cost.不断的产品开发从而降低了操作成本。
- Lower running cost achieved through improved speed and optimized running conditions and extended bath life.通过提高速度和优化电镀条件，延长槽寿命达到降低运行成本
- Maintain high yield! 维持高良率！



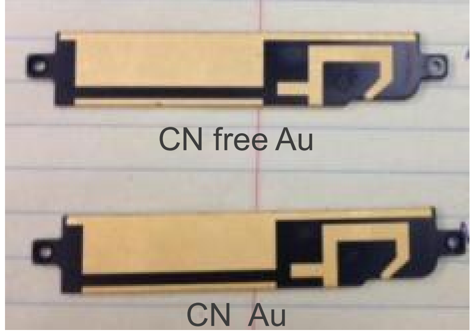
Innovations in Final Finishes
在表面镀上的创新

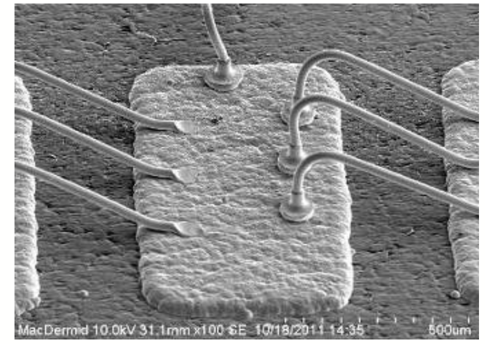
-------- OUR INNOVATIONS-----

- MID Gold 100 CF MID金100 CF
  - A true CN free gold finish一个真正非氰镀金工艺
  - Low operating temp, 40C 较低的工作温度，40℃
  - Neutral pH 中性pH

- MID Palladium 100 MID钯100
  - Wire bondable finish for emerging MID applications 用于新兴的MID打线应用

- MID Silver 100 MID银100
  - Low cost alternative to ENIG 替代ENIG低成本选择
  - Excellent solderability 优良的可焊性
  - Non cyanide process 非氰工艺





There Are No Limits to MID
MID没有止境