ACID COPPER TECHNOLOGIES FOR PLATING ON PLASTICS

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MacDermid Enthone INDUSTRIAL SOLUTIONS
Why Plate Acid Copper?

- Bright and level surface contributes to overall appearance of plated finish
- Buffers effect of stress created between plastic, nickel metal layers due to quick changes in temperature
- General requirements of acid copper plating
  - Good brightness across entire current density range
  - Leveling power
  - Good ductility of copper layer
  - Minimum defect rate
CROSS SECTION REPRESENTATION

- Electroless plate ~ 0.5 µm
- Cu Strike ~ 2.5 µm
- Semi Bright Nickel ~ 18 µm
- Bright Nickel ~ 10 µm
- Copper ~ 25 µm
- Microporous Nickel ~ 2.5 - 3 µm
- Chrome ~ 0.25 µm
- Electroless plate ~ 0.5 µm
MARKET DRIVERS

- Simple part geometry
- Limited range of articles
- More simple test requirements
- Poor molding quality

- More complicated geometry
- Diverse range of articles
- Increased test requirements
- Improved molding quality
INCREASED REQUIREMENTS

- **OEMs** increase copper thickness requirements coupled with new specifications
- Improving thermocycle results
- Reduction in plated part stress
SUPPLIER CHALLENGES

– Increase thickness without reducing capacity
  • Longer plating times
– Significant increase of current densities
– More complex shielding to eliminate burning
MEETING THE DEMANDS

- Flexibility via service tools to fulfill customer needs
- Ability to adjust leveling performance virtually eliminates
  - Orange peel
  - Over leveling
  - Flame patterns
  - Pitting
- Increased temperature
- Reducing burning at HCD
- Increased usage of auxiliary anodes
- Fully analyzable (HPLC, bubble tensiometer, CVS)
WHO NEEDS BETTER TECHNOLOGY?

• POP applicators struggling with complex geometries
  • No HCD burning
  • Good throwing power into the LCD
• Struggling with pitting on parts
• Attempting to cover molding irregularities

THE SOLUTION: DYE-FREE ACID COPPER
DYE-FREE ACID COPPER SYSTEM ADVANTAGES

- Good leveling
- No over leveling
- No sludge formation
- Clean tank walls & anode bags
- Reduced risk of pitting
- Eliminates need for carbon filtration
- Excellent throwing power
- Lower risk for flame patterns
OVER-LEVELING

Sharp edges
Gives double edge appearance
Happens on bright and satin finishes
OVER-LEVELING

Over-leveling occurs:
Sharp edges facing air agitation

Over-leveling disappears:
Sharp edges away from air agitation

Direction of Air Agitation

MacDermid Enthone
INDUSTRIAL SOLUTIONS
LEVELING

Current Acid Copper
Poor leveling

NEW DYE-FREE SYSTEM
No over leveling
THICKNESS DISTRIBUTION

Customer 1
- Less *cracks* after converting

Customer 2
- Less *burning* after converting
PITTING

Current Acid Copper
Pitting

NEW DYE-FREE SYSTEM
No pitting
FLAME PATTERNS
EDGE DEFECTS

NEW DYE FREE SYSTEM
No edge defects even after
3 hours plating
PROCESS ADVANTAGES

• Intermediate layer for variety nickel-chromium layer systems
  ➢ Plastic (ABS, PC-ABS)
  ➢ Plastic in combination with auxiliary anodes
    ➢ Reduced concentration of breakdown products with auxiliary anodes

• No need for carbon filtration in comparison to dye solutions
• Fully analyzable additives and possible breakdown products
• High temperatures are possible (95 to 105°F)
CASE STUDY
PREVIOUS PROCESS LIMITATIONS

- Large POP supplier interior and exterior automotive trim
- Original line configured for 15-20 µm copper thickness
  - New requirements demand 25 µm
- Existing process high risk for burns when CD was increased
- Max temperature 77°F or extreme high usage of brightener
- Additive analysis not feasible
- Continuous carbon filtration required based on the need for auxiliary anodes
Oxidized carrier component concentration increases with increased amp hours.
No significant brightener consumption observed
• Highly accurate measurement of dynamic surface tension
• Monitoring of wetting behavior of surfactant
• Allows simple control of surfactant concentration in acid copper system
CASE STUDY
SUCCESS IN PRODUCTION

• Utilization of auxiliary anodes
• Capable of running at higher temperature (86°F) without extreme increase additive usage, loss of leveling, brightness
• Increase from 25 ASF to 40 ASF without burning
• No need for continuous carbon filtration
• Less maintenance with dye-free system
• Easy conversion from dye-free to dye system
• Controlled usage of additives by analyses
• Process control per HPLC for breakdown products
WORLDWIDE ACCEPTANCE

- In production at >15 plating companies globally
- >500,000 liters of acid copper chemistry converted over the past 2 years
- Q3/Q4 2017: Several new installations planned globally
THANK YOU!

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