

Black Knight

Advanced Dielectric Metallization Process



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Colloidal Graphite Process

Black Knight direct metallization is a proprietary graphite dispersion that makes dielectric material conductive so it can be electroplated with copper. The three-step process makes it possible to plate difficult dielectric material like PTFE & PI in advanced rigid or flexible designs.

Black Knight's unique formula solves the stability and coverage issues associated with older direct metallization processes. The results are the improved reliability required for today's critical applications while reducing processing steps and overall cost.



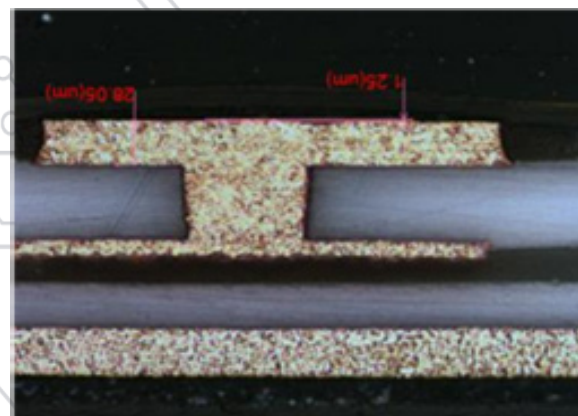
Features

- Superior adhesion to Cu and dielectric materials
- Elimination of heavy metals and formaldehyde
- Reduced water usage
- Simple 4 step process with easy process control
- Fine particle size
- Unique proprietary additives
- Resistant to contamination



Benefits

- Unsurpassed reliability
- Green process eliminates environmental and health hazards with reduced water usage
- High productivity resulting in major cost savings
- Reduced labor requirements for production and process control
- Excellent coverage of difficult to plate materials like PI, PTFE & LCP
- Long bath life yielding cost savings and consistent coverage





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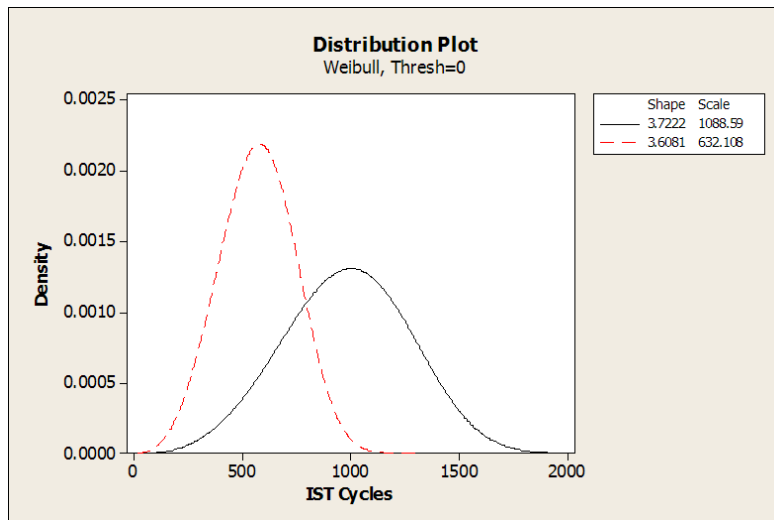
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Reliability Results:

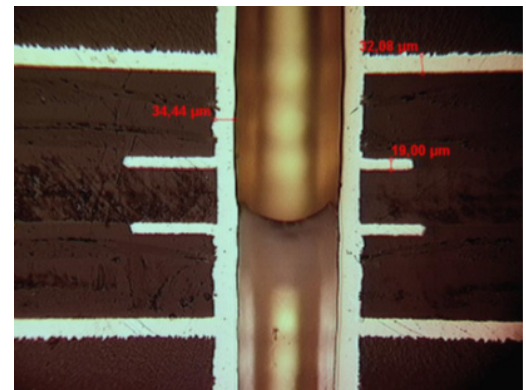
The Black Knight process improves reliability, making it possible to produce advanced technology at an overall cost savings. Rigid, flex, PI, PTFE, LCP, complex design, HDI, BV, high aspect ratios do not matter, Black Knight makes it possible.

| Reliability Test | Test Conditions | Acceptability Criteria | Black Knight Results |
|------------------|---|----------------------------------|---|
| Hot Oil Shock | <ul style="list-style-type: none"> 260 °C/20 sec:cooling 10 sec 20 times | Drop less than 10% in resistance | Pass |
| Thermal Shock | <ul style="list-style-type: none"> 125 °C / 40 °C 15 min 500 times | Drop less than 10% in resistance | Pass |
| Reflow | <ul style="list-style-type: none"> Max 260 °C 20 sec 12 times | Drop less than 10% in resistance | Pass |
| Solder Float | <ul style="list-style-type: none"> 288 °C 10 sec 6 times | Drop less than 10% in resistance | Pass |
| IST | <ul style="list-style-type: none"> 125 °C/ - 40°C 15 min hold time | Drop less than 10% in resistance | Black Knight exceeds most electroless copper results with average of ~1000 cycles |

Black Knight vs. Electroless Cu IST Distributions



Black Knight averages 1000 IST Cycles



IST test coupon after 1000 cycles



Solder shock PI flex multilayer