

# Additive manufacturing method of producing silver or copper tracks on polyimide film

## OVERVIEW

A team within Heriot-Watt University (Edinburgh, Scotland) has patent pending for a method of directly writing metallic tracks on polymer surfaces. Developed within Professor Marc Desmulliez research group, this fine line photo-catalytic deposition system is suitable for applications within microelectronics such as Flex or Flex-Rigid PCB and Microsystems manufacture.

## PROBLEM THIS TECHNOLOGY SOLVES:

Provides an alternative to subtractive de-metallisation processes (e.g. etching/stripping) using an additive process supported by a novel bio-degradable photo-initiator package.

## TECHNOLOGY

Flexible circuits comprising plastics or polymers are increasingly common within mobile phones, laptops and PDA's due to their flexibility, durability, chemical resistance and light weight. Many flex circuits are based on polyester, Liquid Crystalline Polymers (LCP) or more commonly,

Polyimide. A key challenge in making such circuits is the metallisation step where a metal film such as copper is laminated to the polymer using adhesive or deposited under vacuum or another chemical process. The circuit is then developed using a suitable chemical etching process creating large volumes of waste solution for disposal.

Polyimide offers a balance of properties suitable for flex circuits; Polyimide polymers contain an imide ring that when treated with a caustic solution (e.g. Potassium Hydroxide, KOH) can be opened and then "ion-exchanged" with a suitable reagent (e.g. Silver Nitrate, AgNO<sub>3</sub>) to form a metal ion containing active site suitable for further chemical or Photo-deposition reactions to form conductive tracks.

Building on previous work by Hoyd-Gigg Ng et al. [1,2], Heriot-Watt has developed an additive film metallisation process using a novel light activated photo-catalysis process to directly create conductive metal tracks on polymer films. Using short wave UV or visible light to initiate a reaction, the tracks show high adhesion to Polyimide and are suitable for electro/ electroless plating using existing bath technologies (Gold/ Copper/ Silver etc.).

Pictures & PhD project overview available at:  
*MISEC Overview - Polyimide Metallisation*



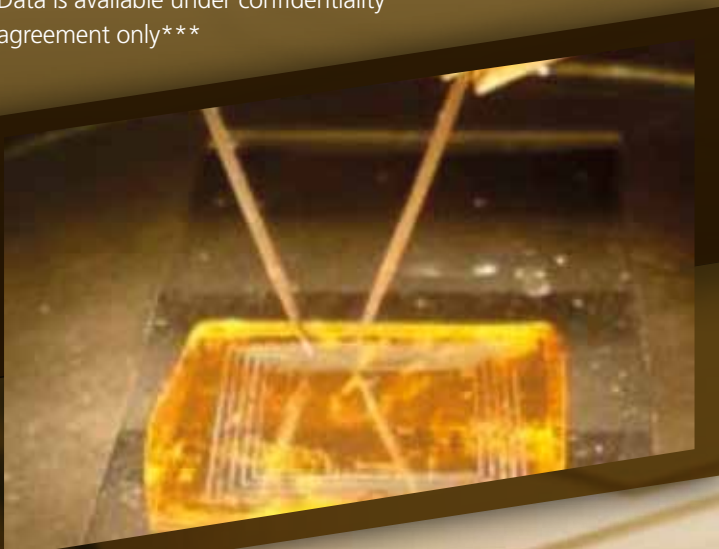
## BENEFITS & APPLICATIONS:

- Main application is Flex & Flex-Rigid PCB's / Micro-electronics circuits on Polyimide film
- RF Shielding, Antenna & PCB prototyping
- Direct writing of metallic tracks on films
- Additive metallisation process – reduces waste/ reagent disposal costs
- Applicable to planar surfaces – films, boards etc...
- Reel to Reel processing possible using suitable line
- Compatible with existing electroless/ electroplating bath solutions

## STAGE OF DEVELOPMENT

Technology and "Proof of Concept" has been demonstrated on a lab bench using PCB grade Polyimide film (DuPont), exposure and HWU proprietary catalyst/ coating producing conductive tracks of <10 micron line width.

\*\*\*Design, Performance & Experimental Data is available under confidentiality agreement only\*\*\*



## INTELLECTUAL PROPERTY STATUS

GB patent application (Feb 2011, GB1101907.2) establishing a priority date to protect the method, apparatus and catalyst materials.

Several background technical white papers by the inventor are available on-line:

1. "Silver Nanocluster Formation using UV Radiation for Direct Metal Patterning on Polyimide", D E Watson, J H-G Ng, J Sigwarth, J Bates, M.P.Y Desmulliez. 3rd ESTC Conference Sep 2010.
2. J.H.-G. Ng, M.P.Y. Desmulliez, K.A. Prior and D.P. Hand, "Ultra-violet Direct Patterning of Metal on Polyimide", Micro & Nano Letters, 3, 2008, pp. 82-89.

Technology is available for license in all fields of use on exclusive/ non-exclusive basis.

## COMMERCIAL OPPORTUNITY

Heriot-Watt now seeks microelectronic system developers and integrators with experience of Flex/ Flex-Rigid PCB manufacture who see utility in the applications of this technology.

Partners should have an interest in either obtaining a licence to develop this technology or to act as industrial sponsors to collaborate and provide financial (or "in-kind") support for technological developments in specific defined areas.

UK companies (or overseas companies with a UK presence) may be eligible for UK government or Scottish Development Agency financial support to develop this Heriot-Watt technology through an industry/ university knowledge transfer partnership: **Knowledge Transfer Partnership Scheme** or **Scottish Enterprise**

## FOR FURTHER INFORMATION:

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