LEAD ORGANIZATION: MicroConnex

PROJECT: Bulk-conductivity High Density Interconnects Through R2R Seed Layer Printing and Electrodeposition

ABSTRACT

This proposal addresses the need within the flexible hybrid electronics community for high density, sub-50 um space and trace (S&T) interconnect features with bulk printed circuit copper conductivity. High conductivity interconnects on flex provide the fundamental base for hybrid integration of integrated circuit, passive, and printed components. The proposed manufacturing process seeks to achieve 10 um S&T with bulk conductivity and high process yield by combining roll-to-roll printing of patterned thin (<100 nm) seed material, followed by electrodeposition. This process will produce copper and gold-clad high density interconnects in a scalable, high throughput process on flex to enable low resistance, hybrid integration on flex. Leveraging the design for manufacturability and flex circuit resources and knowhow of MicroConnex, Inc. and the scalable roll-to-roll printed electronics capabilities at the University of Washington's (UW) Washington Clean Energy Testbeds (WCET), this project will significantly enhance the FHE technology base. Subsequent to delivery of the proposed process technology, the partners provide direct access to this developed technology consistent with MicroConnex's position as a cutting edge flex circuit manufacturer and the open access model of the UW Testbeds for academic, government and commercial FHE users.

Fig 1. Highly engineered flex circuitry produced

Fig 2. The multilayer, R2R processing tool at the UW's WCET with high-resolution flexography, rotary screen, offset gravure and slot die coating capability.

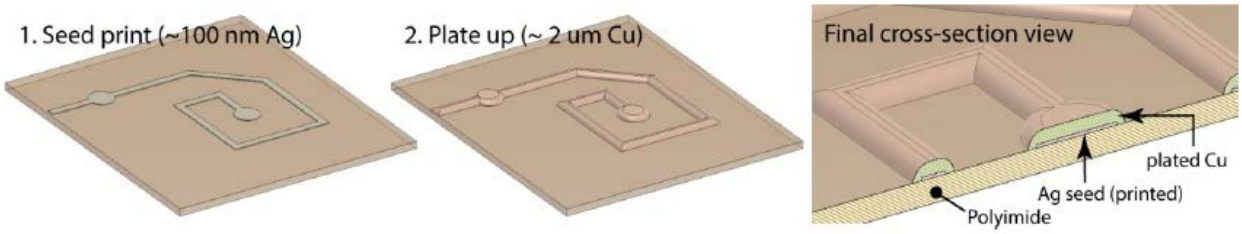

Fig 3. High-level schematic of proposed process flow option 1 (dimensions not to scale). A thin R2R printed seed layer defines the desired circuit geometry (1) while subsequent electroplating achieves the desired conductivity (2).

Systematic design-of-experiments-driven exploration of process parameter space for both R2R and electroplating components, combined with automated electrical, optical, and XRF inspection, will result in a large and statistically robust dataset. The resulting data, in turn, will yield both design criteria (bussing and tie bar density) and an empirically modeled 'cook book' correlating feature dimensions, conductivities, and yields, to both R2R and electroplating process parameters.