DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

SEMI-AUTOMATED VIA ELECTROPLATING SYSTEM

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INTRODUCTION

Copper electroplating is the process of depositing copper particles onto a charged surface. It is used in industry to plate vias, which are paths between layers of Printed Circuit Boards (PCBs). Currently in the LSU PCB Lab, the method of plating vias is unreliable. In order to make the process more efficient, hands-free and predictable, our team designed and constructed a semi-automated via electroplating system.

OBJECTIVES

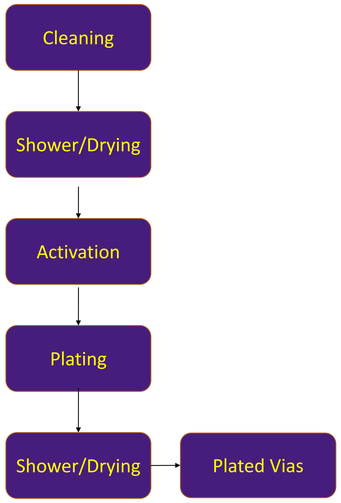
- Develop a device to eliminate user inaccuracy by implementing as many autonomous functions as possible/necessary
- Enhance quality of vias
- Handle copper boards of variable size
- Produce functioning vias
- Provide user with an interface
- Provide limited system interactivity
- Provide visuals via touch screen and acrylic
- Provide alarms for system processes via speaker
- Successfully go through electroplating process and let user retrieve final product
- Provide user with ability to stop electroplating process
- Provide descriptions and walkthroughs of the process via touch screen

RESULTS

- Fully functional User Interface via touchscreen
- Vertical and Horizontal motors successfully move boards between tanks
- Motors successfully self-calibrate with the help of position switches situated at ends of motor tracks
- Relays properly control the pump, dryer, and heaters
- Float sensors accurately alert user when tanks are low
- Speaker provides alerts to the users
- Power supply and bus PCB successfully power devices
- Voltage controlled variable current supply provides necessary direct current for plating
- Control logic implemented successfully with Raspberry Pi
- Frame design supports weight of components
- Temperature sensors fully functional in relations to heaters. The sensors will detect temperature and turn heaters on/off according to high/low temperature readings.

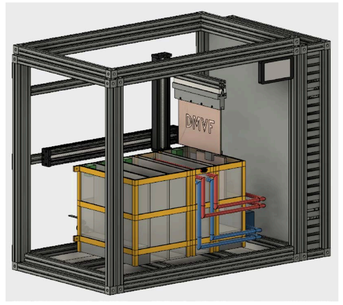
- Plastic welding of tanks did not produce fully sealed containers. This prevented a full system test
- Plating tests revealed original direct current plating method not as effective as reverse pulse plating. Reverse plating was implemented using relays

ELECTROPLATING PROCESS

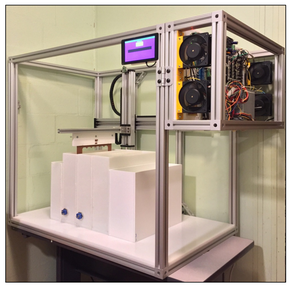


- Start with pre-drilled board
- Wait for user attachment to motor arm
- Move the motor arm to first and second cleaning tank
- Move board to shower/drying tank
- Rinse and dry board to prepare for activator tank
- Apply activator, which coats via with conductive ink to facilitate plating
- Prompt user to remove excess ink and inspect the quality via touchscreen after the activator is applied
- Prompt user to reattach the board and confirm
- Allow user to enter the desired plating current
- Move board to plating tank
- Apply current for specified amount of time
- Move the board to shower/drying tank to rinse and dry
- Allow user to retrieve final product

DESIGN



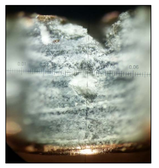
CONCEPTUAL DESIGN



PROTOTYPE

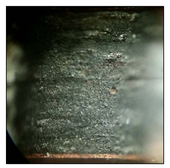
COPPER PLATING

When vias are first drilled, the insulator in the middle of the board is exposed, The next step is to apply a conductive ink.



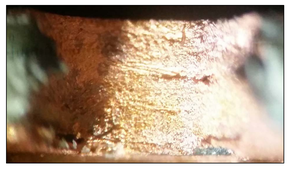
10x image of unplated, unactivated via

As the insulator is non-conductive, a conductive ink is applied to the surface of the exposed insulator and dried. This allows a small amount of electrons to pass through the hole and start the plating process. The next step is to submerge the board in the plating solution and supply electrons



10x image of via coated in activator

The plating solution contains dissolved copper ions (Cu2+) which bond with the surface of the through-holes when a current is applied.



10x image of copper coated via

COMPONENTS