



No Design For Manufacturing (NDFM)

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Concept

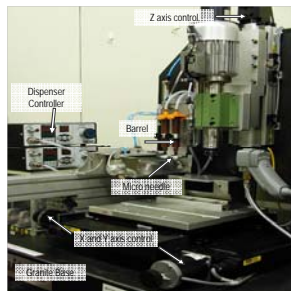
- Electronic goods have an electrical circuit.
- Interconnection of resistors, inductors, capacitors, and etc.
- The normal circuit doesn't cross lines.
- Insulator on a cross point



Objective

- To connect all element by straight line having cross sections.
 - Making small electric circuit with easy way.
 - New technique for an easy & fast way to make an electrical circuit.

HARDWARE SYSTEM OF NDFM



- ✓ Putting solder in a barrel
- ✓ Applying heat and pressure
- ✓ Liquid solder pressing out through the nozzle
- ✓ Moving head makes the lines
- ✓ Moving head is controlled by NC code

MATERIALS

Solder

Low temp. lead

Sn, Ag lead

Soldering lead

Sn, Bi Alloy

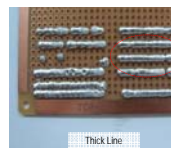
Insulator

MANUFACTURING PROCESS

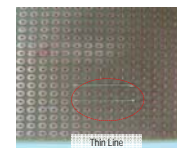
Line components

Experimental condition

Nozzle speed	Nozzle Dia.	Cylinder Temp.	Air pressure	Height (from nozzle to board)
1.5 mm/s	500 μ m	160 $^{\circ}$ C	11 KPa	47 mm



Thick Line



Thin Line

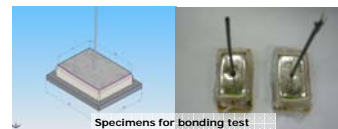
Interconnection



- ✓ Cross point should be checked.
- ✓ Simple circuit to operate a miniature bulb works.



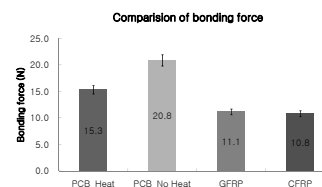
Bonding test



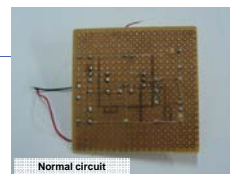
Specimens for bonding test



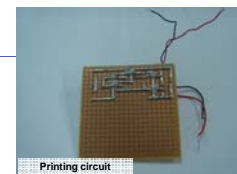
Pull out test



Electrical circuit



Normal circuit



Printing circuit

Advantage

- ✓ Low material consumption
- ✓ Minimal waste
- ✓ Simple and straightforward process with fewer steps

CONCLUSIONS

- The design and manufacturing of RP printing were tested.
- Firstly, variable fusible alloy and its operation condition were tested.
- Secondly, the bonding strength between fusible alloy and substrate was investigated.
- Lastly, electrical circuits made by RP printing.

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