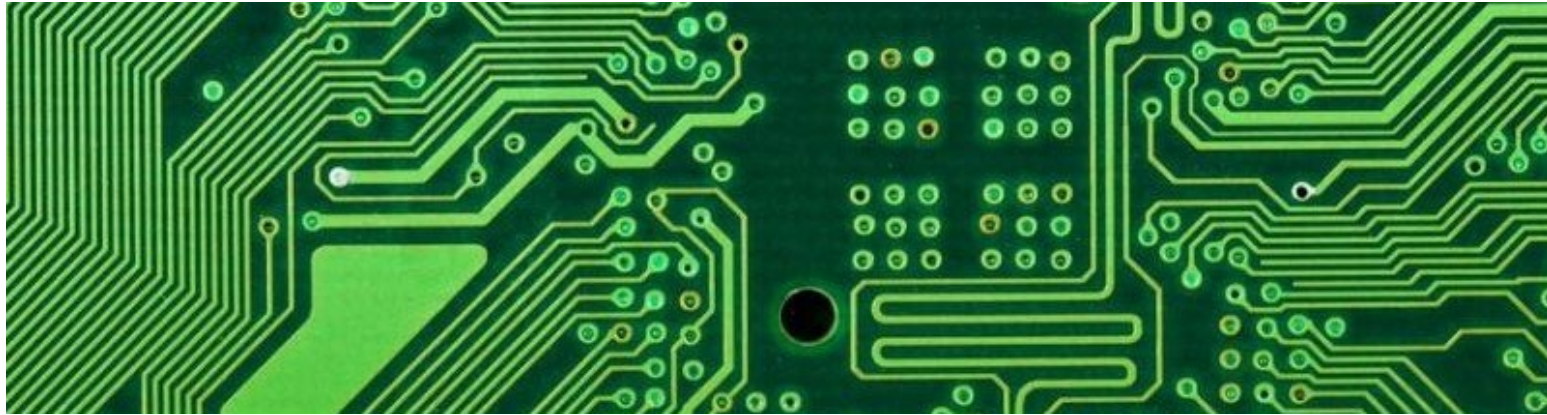
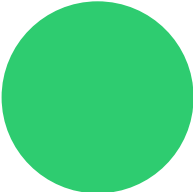


Printed Circuit Board

Federico Marino - Electronic Systems and Technology - 26/04/2022



Presentation Timeline

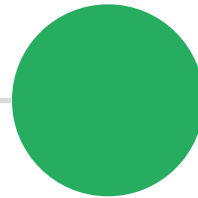


PCB introduction

What is a PCB and what is the main purpose of this technology.

PCB manufacturing

What are the majors' steps behind the PCB manufacturing process?



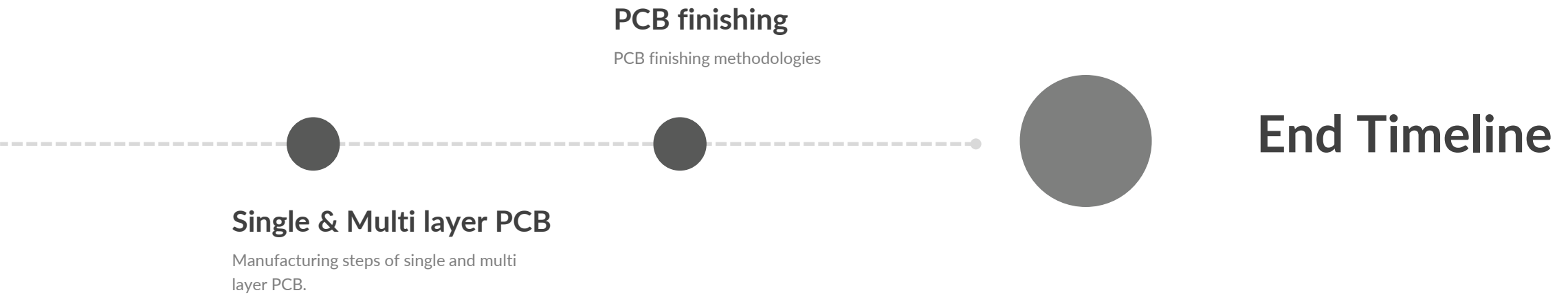
PCB Layers

What are the materials used to build a single or multi-layer PCB?



Substrate & Copper foil





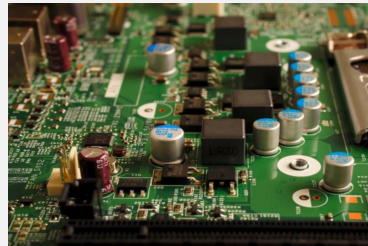
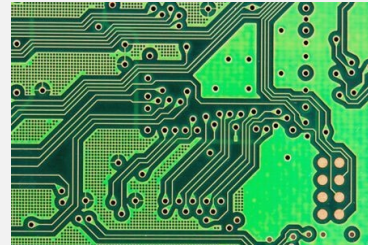
About PCBs

PCB scope?

Connecting and providing mechanical support for the mounted component

PCB & PCBA?

- Printed Circuit Board
- Printed Circuit Board Assembly



SMT & THT?

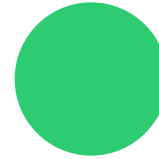
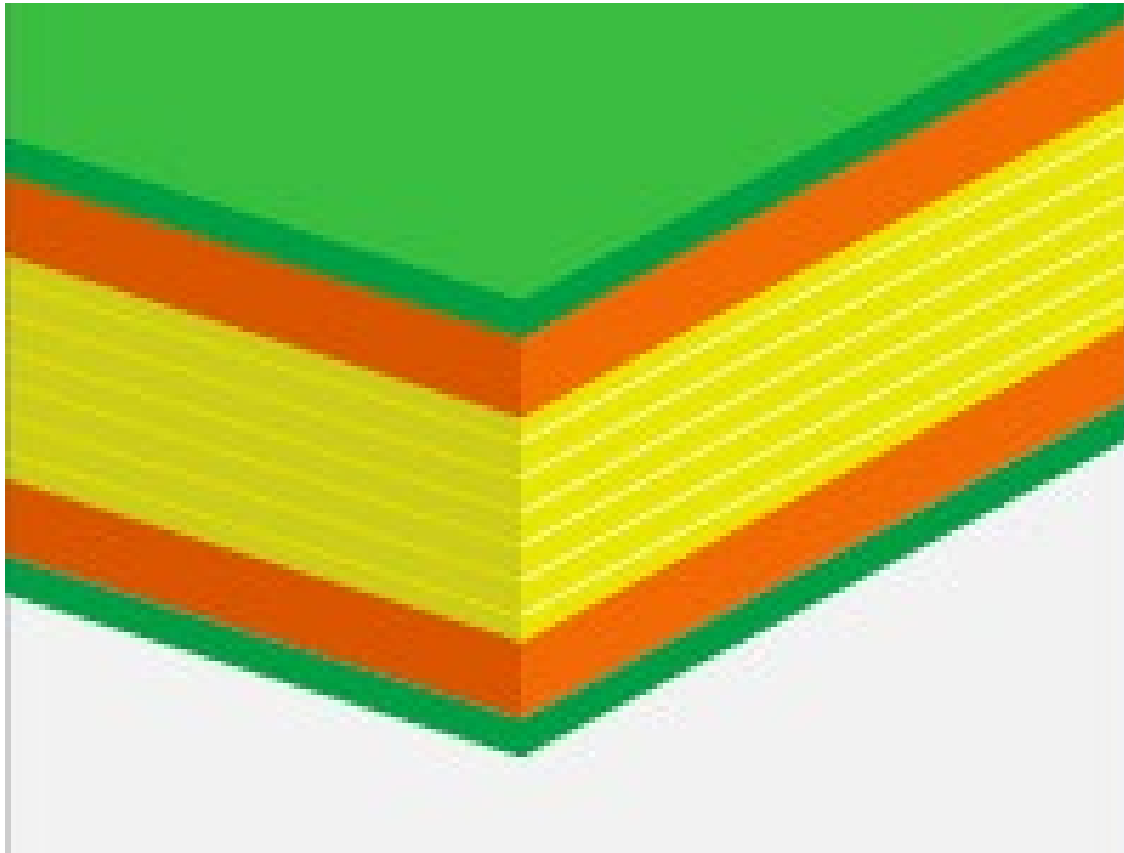
- Surface Mount Technology
- Through Hole Technology



Single and Multi layer PCB's



PCB Layers



Solder Mask

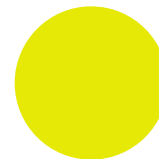
Gives the green color to the PCB and should be kept away from any plated through-hole and its associated land or pad while each conductor track should be covered.



Copper Sheet

Copper is by far the most common base material used to provide on-board connection between components. (9/18/35/70 μm)

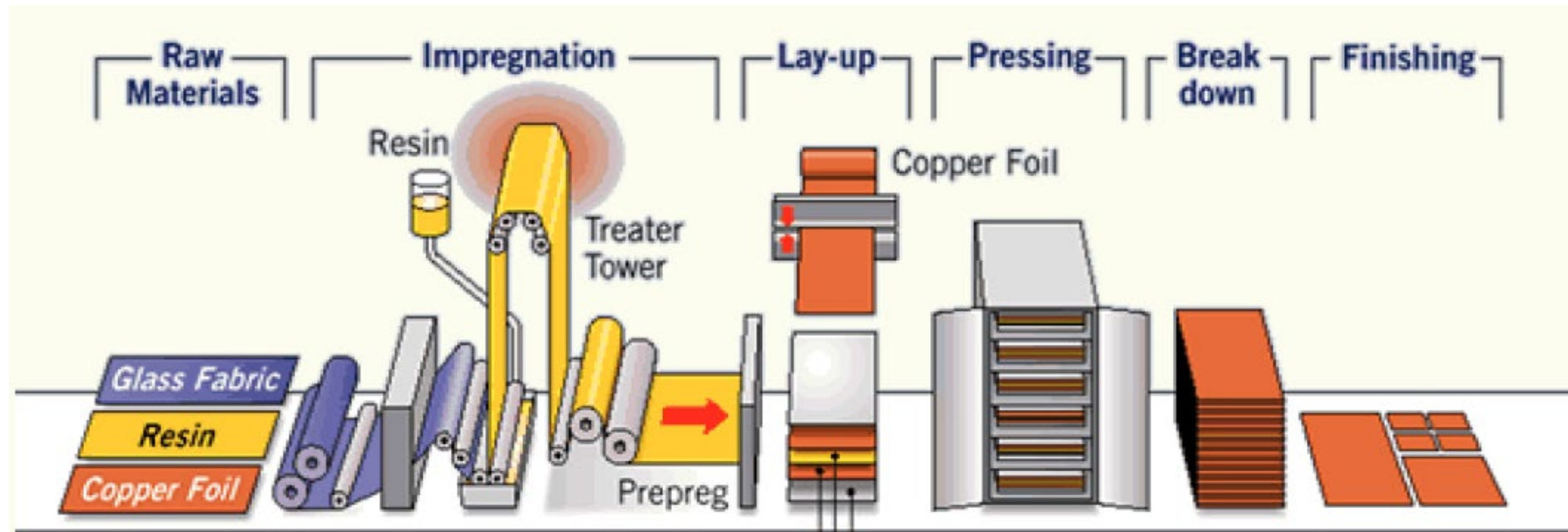
- Its **resistivity is low**, second only to silver, a much more expensive metal.
- Copper is **easy to plate** and forms a stable oxide which bonds well to resin for multilayer applications.
- Plated copper is also a **ductile** material, when plated properly, so that it can make reliable through-hole interconnects,



Substrate (FR4-FR2)

- FR \rightarrow Fire retardant (Commercial and legal requirement)
- FR4 **woven glass** cloth impregnated with **epoxy resin**
- FR2 **cellulose paper** impregnated with **phenolic resin**
- CEM \rightarrow Composite electronic material
- Supplier / Rolling your own
- Working temperature (T_g - Fully reversible), CTE THT problem (Invar), water absorption, thermal conductivity, flexibility

FR-4 Manufacturing Process



Raw Materials

- Glass fabric
- Epoxy resin
- Copper foil

Impregnations

Glass fabric is soaked in a resin bath and pre-heated in the vertical tower to partially cure the resin (FR-2 is done horizontally). Aging problem Ts

Pressing and Heating

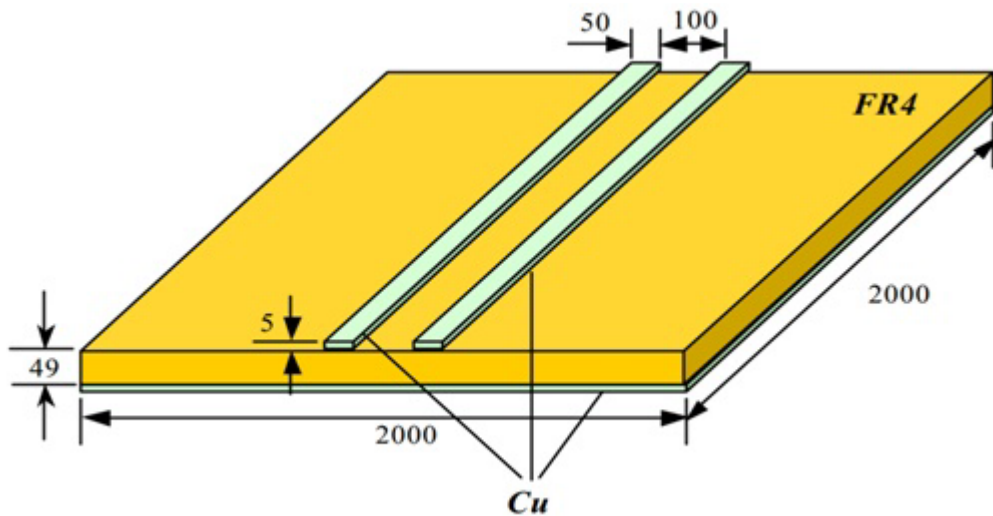
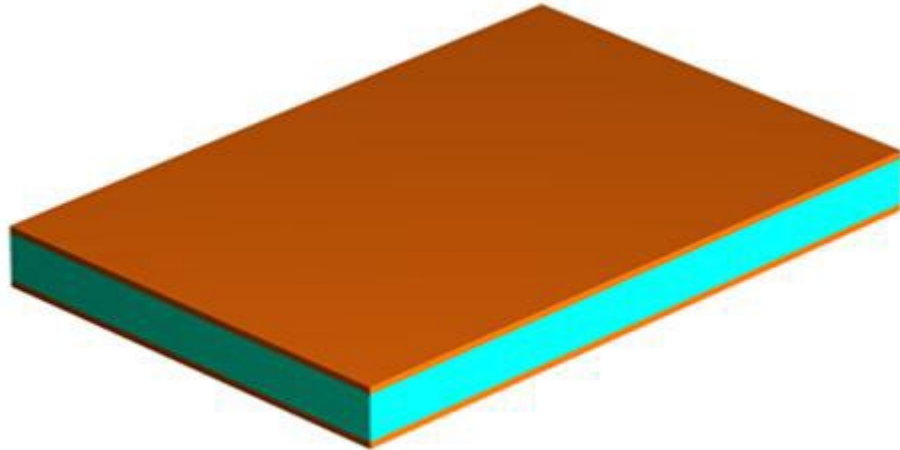
1 Laminate is produced
(Copper + Prepreg + Copper)
Stainless steel press plate are used.
35 bar - 175° - 1h

Finishing

Laminates are cut and refined

1- Dissolve readily in safe and inexpensive solvents, so are easy to use for impregnating 2 - Adhere well to both copper foil and electroless copper (FR - 2 cannot be used through hole processes) 3 - Bond well to glass fibre finished with epoxy-silane 4 - Drill easily (bits are deflected by the glass fibres, rather than the resin) 5 - Can be formulated to be flame-retardant.

What's the next step?



RESISTANCE

Conductor heating and power loss (Depends on conductor thickness and track width)

$$R = \rho * \frac{L}{A}$$

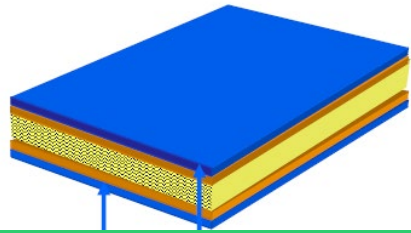
CAPACITANCE & INDUCTANCE

Producing signal delay (Depends on conductor thickness and track width and track length)

COUPLING

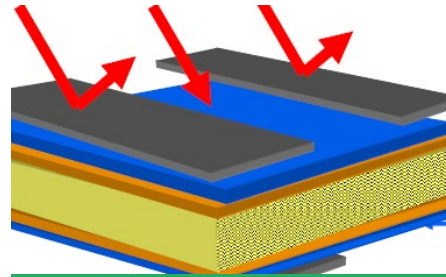
Noise and incorrect circuit functioning (Depends on length and proximity of coupled tracks)

How to build PCB inner layer?



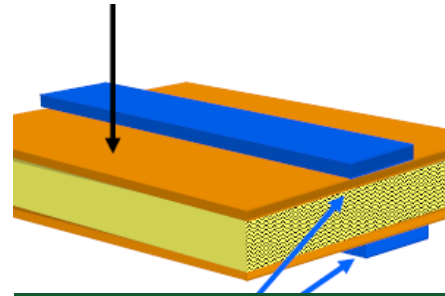
Resist Coating

The whole board surface is coated with a thin layer of photosensitive etch resist ('photoresist') by applying pressure and heat, either by a liquid process or as a 'dry film'.



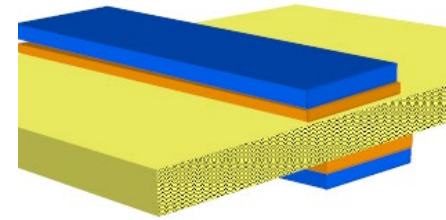
Exposing

This resist layer is exposed to ultra-violet light through a photomask, so that the areas protecting the required pattern are polymerised and hardened.



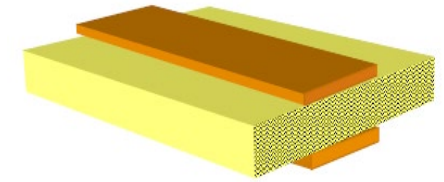
Developing

Unhardened photoresist is removed by 'developing'



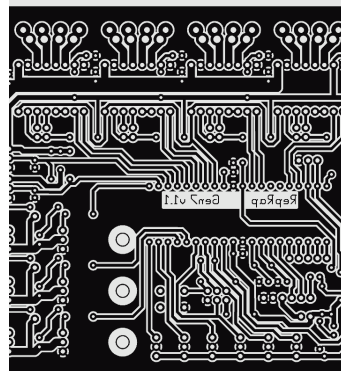
Etching

The remaining resist is baked to increase its etch resistance, and the board is then etched. This chemical process can be based on cupric chloride (Tin Problem) or ammoniac (Over etched)

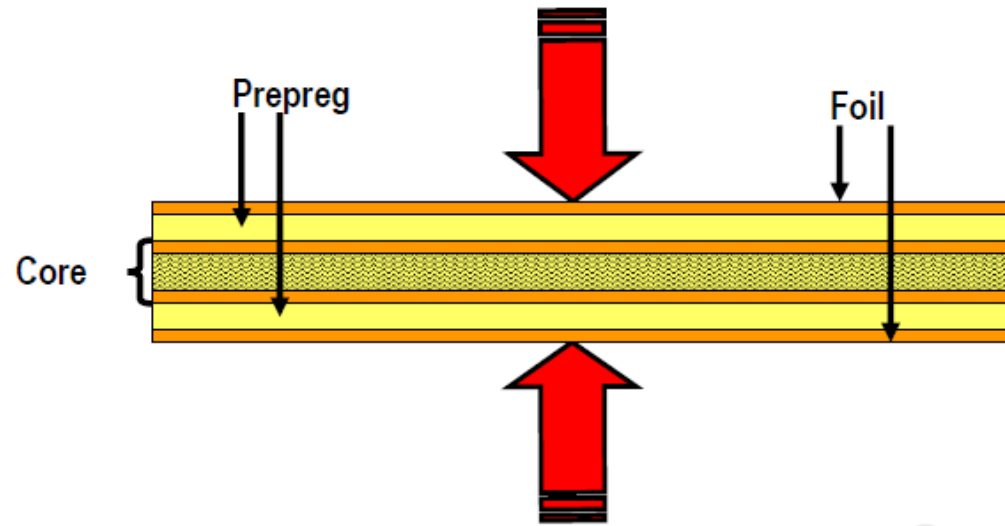


Stripping

Remove the polymerized resin.



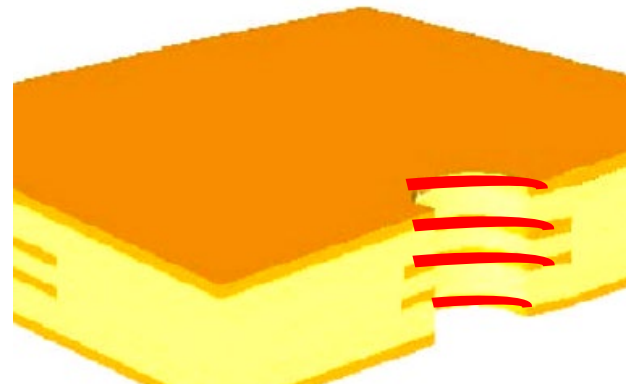
Multi layer PCB manufacturing



Advanced



Drilling

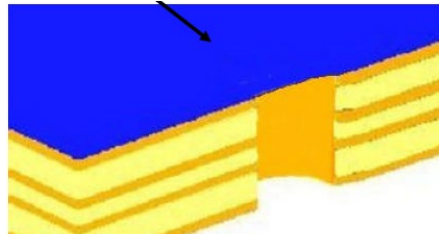


Clean Holes

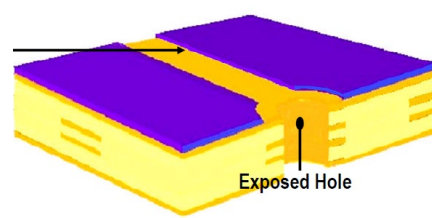


Electroless Plating

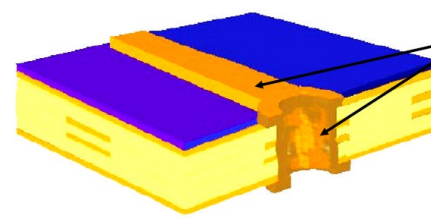
Multi layer PCB manufacturing



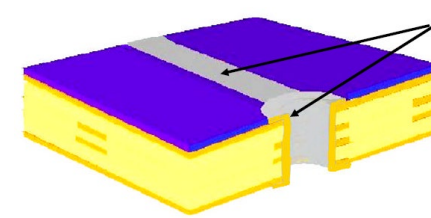
Resist Coating



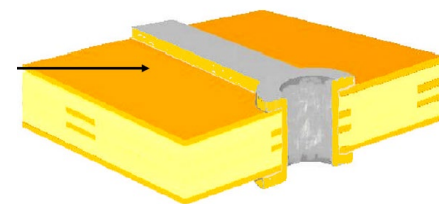
Exposing/Developing



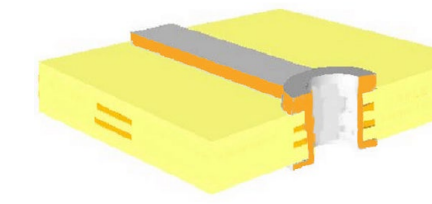
Copper Plating



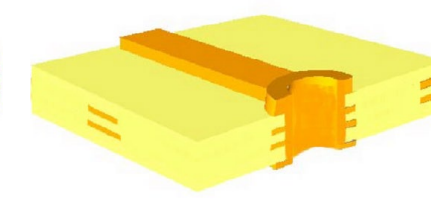
Tin Plating



Resist Stripping

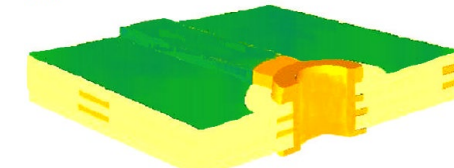


Etching

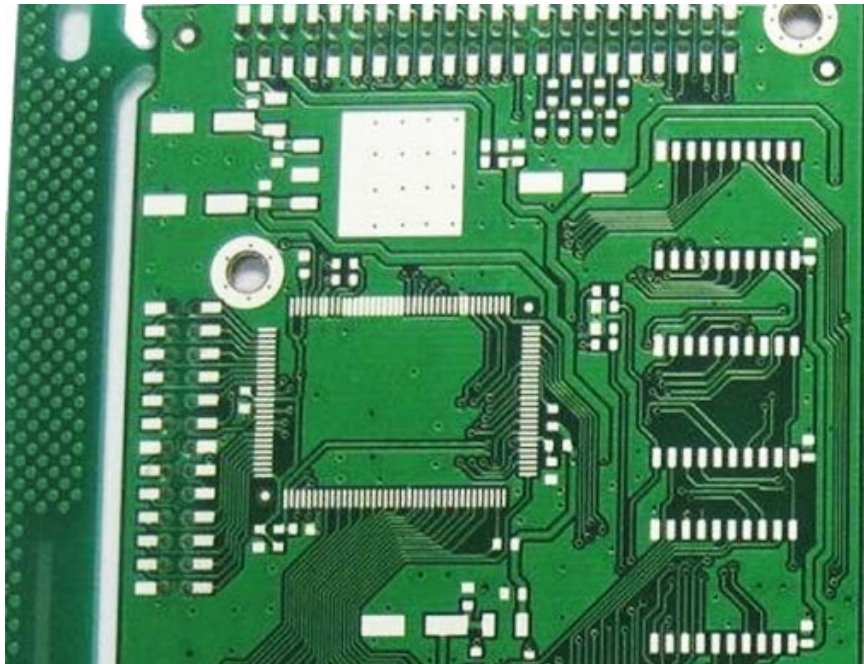
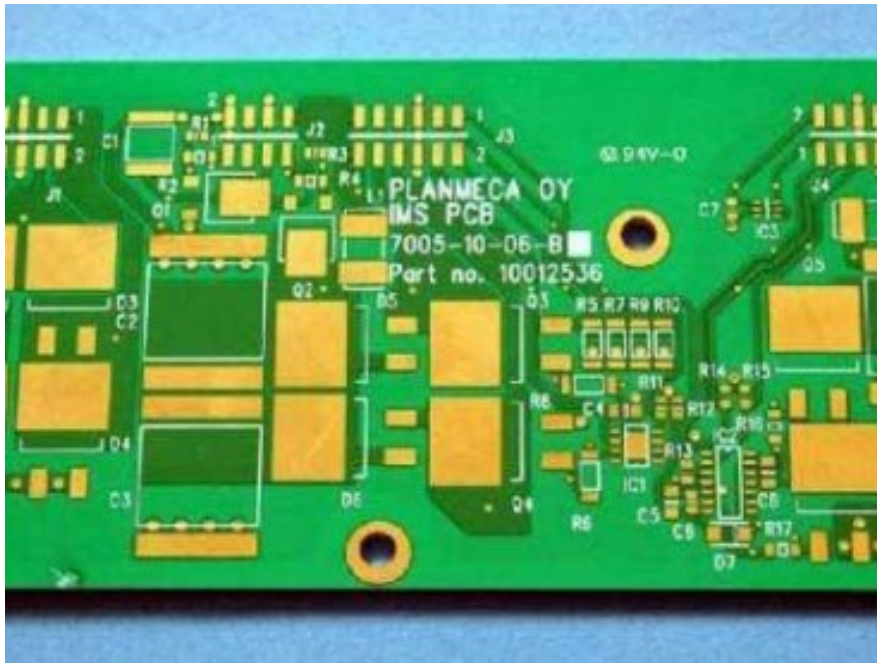


Tin Stripping

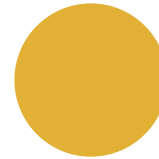
ork.



Mask Application

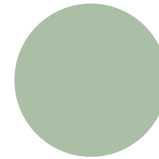


Surface finishing



Gold coat

Increase solderability and wettability and will not degrade with time. The problem is oxidation of the under layer of copper, so an intermediate layer of tin is required.



Tin / Tin-Lead Coat

Directly Tin can be used as surface finishing as solder paste is basically done of the same material. Electroplating (Make thicker the one used for etching).

Tin-Lead coating by dipping in hot solder, by printing solder paste and than fuse it on the pads.

Thanks for the attention, questions?