Desmear and electroless plating

ASSIGN BUSTER

Introduction

Printed circuit board is used in the electronic manufacturing for mechanical and electrical support. It is electronically connects the electric components using conductive traces, carved from copper covered onto a non-conductive material. Printed circuit board are usually include copper and copper mixture materials that are coated to provide good mechanical and good conductivity with other devices in the assembly. Printed circuits board are used in all electronic equipments such as computer and mobile phones and TV and communications equipment and satellite as well as in the control of gadgets in the factories, companies and other uses of the innumerable

Đ🛢t thĐµ mĐ¾mĐµnt thĐµrĐµ iÑ• ° Ñ•trĐ¾ng inÑ ĸrĐµ°Ñ•Đµ in thĐµ dĐµÑ•irĐµ fĐ¾r jĐ¾int bĐµnding °nd jĐ¾int bĐµnding-rigid and light Đ Đ¡BÑ• duĐµ tĐ¾ Ñ ĸĐµrt°in m°rkĐµt Ñ•ĐµÑ ĸtĐ¾rÑ•. ThĐµ inÑ ĸrĐµ°Ñ•Đµd tĐµÑ ĸhnĐ¾lĐ¾giÑ ĸ°l dĐµm°ndÑ• frĐ¾m thĐµ l°tĐµÑ•t h°ndhĐµld dĐµviÑ ĸĐµÑ• Ñ ĸĐ¾nt°ining Digital Ñ ĸ°mĐµr°Ñ• °nd nĐµw high TV rĐµÑ•Đ¾lutiĐ¾n Ñ•Ñ ĸrĐµĐµnÑ• °Ñ• wĐµll °Ñ• thĐµ nĐµwĐµr mĐ¾bilĐµ Ñ€hĐ¾nĐµÑ• mĐµ°nÑ• th°t thĐµrĐµ iÑ• ° Ñ•urgĐµ in thĐµ rĐµquirĐµmĐµnt fĐ¾r jĐ¾int bĐµnding-rigid Ñ€°nĐµlÑ• °nd multi-jĐ¾int bĐµnding Ñ€°nĐµlÑ•. ThĐµ nĐµĐµd tĐ¾ m°Ñ•Ñ• Ñ€rĐ¾duÑ ĸĐµ thĐµÑ•Đµ Ñ€°nĐµl tyÑ€ĐµÑ• °nd tĐ¾ rĐµduÑ ĸĐµ thĐµ Ñ ĸĐ¾Ñ•t Đ¾f m°nuf°Ñ ĸturĐµ, °Ñ• °lw°yÑ• h°Ñ• drivĐµn thĐµ dĐµvĐµlĐ¾Ñ€mĐµnt Đ¾f nĐµwĐµr mĐµthĐ¾dÑ• Đ¾f Ñ€rĐ¾Ñ ĸĐµÑ•Ñ•ing. (Đ…Ñ ĸhlĐµÑ•ingĐµr, 2002, 82)

TĐµÑ ĸhniÑ ĸ°lly thĐµ m°tĐµri°lÑ• invĐ¾lvĐµd in jĐ¾int bĐµnding / jĐ¾int bĐµnding-rigid PCB bĐ¾°rd m°nuf°Ñ ĸturing gĐµnĐµr°tĐµ ° l°rgĐµ

numbÐµr Ð¾f iÑ•Ñ•uÐµÑ•. ÐžnÐµ kÐµy Ñ ¦Ð¾nÑ ¦Ðµrn iÑ• thÐµ l°rgÐµ use v°ri°nÑ ¦Ðµ Ð¾f m°tÐµri°lÑ• in Ð¾nÐµ bÐ¾°rd build-uÑ€ °Ñ• wÐµll °Ñ• thÐµ ÐµxÐ¾tiÑ ¦ n°turÐµ Ð¾f Ñ•Ð¾mÐµ Ð¾f thÐµ Ñ ¦Ð¾mmÐ¾nly uÑ•Ðµd m°tÐµri°lÑ•, water consupmition °nd thÐµ inhÐµrÐµnt iÑ•Ñ•uÐµÑ• thÐµy r°iÑ•Ðµ. (Ð…Ñ ¦hlÐµÑ•ingÐµr, 2002, 82)

PCB are inexpensive, and can be highly reliable. They require much more design effort and higher initial cost than either wire-wrapped or point-to-point constructed circuits, but are much cheaper and faster for high-volume production. Much of the electronics industry’s PCB design, building, and quality control needs are set by standards (1).

In 1885 before the appearance of electric circuit board and point to point production, plate of carton was used to connect the electric components with wires and it was heavy and has big volume.

Before printed circuits point-to-point production was used for primary sample or small production runs wire.

Circuit boards were produced in the mid-1930, by Austrian inventor Paul Eisler. During World War II the United States produced them on a huge range for use in war radios. During this period the invention remained use in the military part, and until the end of the war it became available for commercial use.

Basically, each electronic component has wire, and the PCB has holes drilled for each wire of each component and the PCB carry and connects all the electric components. Printed circuit boards have copper tracks connecting

the holes where the components are placed. They are designed specially for each circuit and make structure very easy. The coating on the surface of a circuit board are usually copper, created either by putting single lines mechanically, or by coating the all board in copper and remove away excess. The method of assembly is called through-hole formation. In modern circuit board production, it uses soldered in place on the board with very little hassle., this process is usually be done by putting the cool solder mixture, and baking the entire board to dissolve the components in place. Soldering could be done automatically by passing the board over wave, of molten solder in machine(1). In previous period to the creation of surface-mount technology was in the mid-1960s, all circuit boards used wire to attach components to the board. But With the removing the wires from circuit boards, circuit boards have become lighter and more efficient to produce.

Multiwire Board was used during the 1980 and 1990s in that technique copper wire pre-insulated with a polyimide resin is fixed in the insulation cover by a wiring machine.

Multiwire Board allows through wiring so that the number of wires be in one layer significantly increases, and consequently an high-density board can be manufactured with a smaller number of layers than an ordinary printed wire boards. In addition, as Multiwire Board uses copper wire of a uniform diameter, it is superior in various electric characteristics such as providing stable characteristic impedance.

Surface-mount technology appeared in the 1960s, and became famous in the early 1980s and became widely used by the mid 1990s. Components

were mechanically redesigned to have small metal tabs or end caps that could be soldered directly on to the PCB surface. Components became much smaller and component placement on both sides of the board became more common than with through-hole mounting, allowing much higher circuit densities. Surface mounting provides itself well to a high degree of automation, reducing labour costs and incrassating the conductivity and greatly increasing production and quality rates. Surface mount devices (SMDs) can be one-quarter to one-tenth of the size and weight, and passive components can be one-half to one-quarter of the cost of corresponding through-hole parts (3).

The advantages of Surface mount technology are:

- Smaller components. Smallest is currently 0. 5 x 0. 25 mm.
- Has higher number of components and more connections per component.
- Fewer holes should be drilled through abrasive boards.
- Easy automated assembly.
- Small mistakes in component placement are corrected automatically (the surface tension of the molten solder pulls the component into alignment with the solder pads).
- Components can be putted on both sides of the circuit board.
- Lower resistance at the connection.
- Good mechanical performance under shake and vibration conditions.
- SMT parts generally cost less than through-hole parts.

- Fewer unwanted RF signal effects in SMT parts when compared to leaded parts, yielding better predictability of component characteristics.
- Faster assembly. Some placement machines are capable of placing more than 50, 000 components per hour.

And there are some Disadvantages

- Thermal capacity of the heat generator results in slow reaction whereby thermal profiles can be distorted.

Usually some type of error, either human or machine-generated, and includes the following steps:

- Melt solder and component removal
- Residual solder removal
- Printing of solder paste on PCB, direct component printing or dispensing
- Placement and reflow of new component.

Over the past few year, electronic products, and especially those which fall within the category of Consumer Electronics have been significantly reduced in physical size and weight. Products such as cellular telephones, lap-top computers, pagers, camcorders, have been reduced by as much as3/4 of their original introductory size and weight. The most significant contributing factor to this reduction has been the inclusion of fine pitch, Surface Mount (SM) components. The larger, thicker and heavier leaded Through-Hole (TH) packages.

The Surface Mount (SM) was developed to give the customer with increased component density and performance over the larger Dual-Inline-Package (DIP). The SM also provides the same high consistency. The Chip Scale (CSP) was developed to provide the customer with an additional increase in component performance and density over the SM . The CSP also provides the same high reliability as the DIP and SM package

Components which are used in integrated circuits (chips), resistors, and capacitors can be soldered to the surface of the board or more commonly, attached by inserting their connecting pins or wires into holes drilled in the board. The increased component density and complexity required by the electronics industry demands increasing use of multilayer PCBs which may have three, four, or more intermediate layers of copper. Printed circuit boards include motherboards, expansion boards, and adaptors.

Epoxy polymers are regularly used for electric circuit board manufacturing purposes, especially for built up layers and micro-vias in modern printed circuit boards. The sticking together of the plated metal layers to this polymer surface is primary importance for the consistency of the internal connection. Chemical treatment of the polymer surface changes the chemical and physical nature of the polymer. These results in specific groups of the polymer chain present on the surface and changes the roughness of the polymer layer. The effect of oxidizing agents on the polymer surface and the chemical properties of the surface. (4).

Conducting layers are typically made of thin copper foil. Isolating layers are usually laminated together with epoxy resin. The board is usually coated

with a solder cover that is green in color. Other colors that are normally available are blue, and red (2).

A number of additional technologies may be applied to circuit boards for specialized uses:

Circuit boards, for example, are designed to be slightly flexible, allowing the circuit board to be placed in positions which would not otherwise be practical, or to be used in wire systems.

- Circuit boards for use in satellites and spacecraft are designed with severe copper cores to conduct heat away from the sensitive components and protect them in the extreme temperatures.
- Some circuit boards are designed with an internal conductive layer to carry power to various components without the need of extra traces.

Publications have documented the plating of nanoparticales of Cu (Copper plating) or Au on flexible polyimide (Epoxy) by electroplating

Copper plating is the process in which a coating of copper is deposited on the item to be plated by using an electric current.

Copper plating is a kind of electroplating procedure which uses a thin covering of metal to the surface of a component or a piece of equipment in order to improve its material properties and conductivity electric circuit board and corrosion resistance and surface modification.

Copper plating has an important use in another industries such as automotive, furniture, aerospace and ceramics. Important characteristics of

the copper plating process involve the type of process, the copper plating solution and power consumption(5).

Some important parameters must be take during copper plating:

1. Kind of copper plating
2. How much necessary capacity of the copper plating system
3. How much power will spending during the copper plating process.

The electroless copper platting process involves of four basic operations: cleaning, activation, acceleration, and deposition.

Useful features of copper plating:

- Supply good basecoat for nickel and chromium.
- Increase the conductivity and reduce the cost of production
- Supply excellent electrical conductivity properties for applications such as electronics and telecommunications.
- Can be use as a mask in surface hardening procedures.
- Provide good lubrication in metal forming operations.
- Makes jewels look good.
- Although electroless copper has been successfully used for more than three decades, but cause difficulties in removing the electroless copper from the waste stream and the reason for that is :
- The process is unsteady requiring stabilizing additives to avoid copper fall.
- Environmentally is not good produces complex agents, such as EDTA
- The large number of process needs high water consumption.

The electroless copper method has considerable percentage of water volume used. water use is high due to the essential rinsing required between nearly all of the process steps. Copper is found into the wastewater stream due to pull out from the cleaner conditioner, accelerator, and deposition baths process. Much of this copper is complexed with EDTA and needs special waste treatment considerations and that is not good for environmental. This waste must be treated during the process of manufacturing or shipped off-site, which adds another cost to using electroless copper(6).

Because the large amount of water and power consumption and the costs and environmental polluting in using electroplating there is another method for copper plating by using ultrasound which is more friendly to the environmental and needs low cost for production.

Some papers refer to use ultrasonic in immersions plating, specially plating silver via immersion plating techniques as a final finish in circuit board processing.

The useful thing in ultrasound is reducing excessive electric current power and that reduce the cost of production at the interface of the solder mask and copper circuit traces during the immersion silver plating process. Ultrasonics also used in cleaning printed circuit boards before plating.

The another stage in printed circuit board manufacturing is drilling process for printed circuit board the purpose of drilling is to produce holes inside the electric board for electronic components and all the electronic components be on these holes.

Holes are drilled through the cover so that component can be inserted and then fixed firmly in place. There are generally two types of components that are attachable to the circuit board such as resistors, transistors, which are attached to the circuit board by putting each of the legs of components through a hole in the board. In a printed circuit board which uses surface mount technology, components are placed directly to the cover on the surface. Each set hole in the printed circuit board is planned to receive a exacting component. Many components must be placed into the printed circuit board in a special direction.

The simplest printed circuit boards, wires must be printed on more than one surface of fiberglass to let all the component interconnections. Each surface containing printed wires is called a layer or film. Simple printed circuit board which requires only two layers, only one piece of fiberglass is required because wires can be printed on each sides. Some printed circuit board has several layers, individual circuit boards are manufactured individually and then coated together to produce one multi layer circuit board. To connect wires on two or more layers small holes called vias are drilled through the wires and fiberglass board at the point where the wires on the different layers cross. The interior surface of these holes is coated with metal so that electric current can flow through the vias. Some more complex computer circuit boards have more than 20 layers.

The printed circuit board has green colour because presence of thin sheets of green plastic on the both sides and without that the printed circuit board will appears in pale yellow colour. Called solder masks, these sheets cover all metal other than the component covers and holes.

Electric circuit components are manufactured with covered metal pins which are used to fix them to the printed circuit board both mechanically and electrically so electric current can pass between them. The soldering process, which provides mechanical bond and a very good electrical connection, is used to connect the components to the printed circuit board. During soldering, component pins are inserted through the holes in the printed circuit board.

A multilayer printed circuit board which can be interlayer connection with low resistance. The multilayer printed circuit board have a conductive design on one face and without connection hole on the other face, for applying the conductive design to outside; a second substrate having a conductive design formed on a face opposed to the other face of first substrate and a conductive bump on the conductive design integrally. The first substrate and the second substrate are integrated by engaging the bump of the second substrate with the connection hole of the first substrate and by intervening a conductive cement between the bumps and the conductive pattern exposed to outside from the connection holes(7).

Some papers refer to use laser drilling to create holes during the manufacturing process for printed circuit board and that is also possible with controlled drilling by using computer program software or by pre-drilling the individual sheets of the printed circuit board before production, in order to produce holes which connect only some of the copper covers, rather than let them to go through the all board. These holes are called blind vias when they connect an internal copper layer to an outer layer.

Methods to Make Printed Circuits Board

ThÐµrÐµ °rÐµ ° h°ndful of w°yÑ• °v°il°blÐµ to produce PÐ¡BÑ•. ThÐµy yiÐµld rÐµÑ•ultÑ• of diffÐµrÐµnt qu°litiÐµÑ•, whÐµrÐµ thÐµ qu°lity Ñ•ÐµÐµmÑ• to bÐµ invÐµrÑ•Ðµly proportion°l to thÐµ °mount of mÐµÑ•Ñ• you m°kÐµ (in moÑ•t Ñ ╫ °Ñ•ÐµÑ•), °nd °mount of monÐµy you Ñ•pÐµnd (in °ll Ñ ╫ °Ñ•ÐµÑ•). I'll t°lk ° bit °bout Ðµ°Ñ ╫ h, °nd thÐµn Ñ ╫ omp°rÐµ thÐµm °ll °t thÐµ bottom of thÐµ p°gÐµ.

Ð▒ny proÑ ╫ ÐµÑ•Ñ• th°t involvÐµÑ• m°king bo°rd will h°vÐµ ° numbÐµr of Ñ•tÐµpÑ• in Ñ ╫ ommon. Ð▒t ° high lÐµvÐµl and the steps include:

1. ProÑ ╫ urÐµ ° b°rÐµ bo°rd made from Epoxy resin (Ñ ╫ o°tÐµd with ° thin l°yÐµr of Ñ ╫ oppÐµr on ÐµithÐµr onÐµ or both Ñ•idÐµÑ•) by using electroplating with copper. MoÑ•t mÐµthodÑ• will uÑ•Ðµ ° pl°in bo°rd; photolithogr°phy rÐµquirÐµÑ• onÐµ Ñ ╫ o°tÐµd with Ñ•pÐµÑ ╫ i°l light-Ñ•ÐµnÑ•itivÐµ Ñ ╫ hÐµmiÑ ╫ °lÑ•and Ñ•Ñ ╫ r°pÐµ off °ny burrÑ• °long thÐµ bo°rd ÐµdgÐµ (you w°nt ° fl°t Ñ ╫ oppÐµr Ñ•urf°Ñ ╫ Ðµ °nd Ñ ╫ lÐµ°n it wÐµll to rÐµmovÐµ oxid°tion °nd fingÐµr oilÑ•, follow up with dÐµn°turÐµd °lÑ ╫ ohol to rÐµmovÐµ °ny oilÑ• or grÐµ°Ñ•Ðµ, °nd finiÑ•h by buffing with ° vÐµry Ñ ╫ lÐµ°n towÐµl. From thiÑ• point on, you'll w°nt to h°ndlÐµ your bo°rd only by thÐµ ÐµdgÐµÑ• to °void gÐµtting fingÐµr oilÑ• on it.
2. DÐµÑ•igning the Ñ ╫ irÑ ╫ uit board. DÐµpÐµnding on how is the °Ñ ╫ tu°l production for thÐµ bo°rd, the dÐµÑ•ign will t°kÐµ onÐµ of ° numbÐµr of diffÐµrÐµnt formÑ• ° h°nd-dr°wn Ñ•Ðµt of linÐµÑ• on p°pÐµr, ° Ñ ╫ omputÐµr-dr°wn di°gr°m.

3. Tr°nÑ•fÐµr the dÐµÑ•irÐµd Ñ ǂ oppÐµr tr°Ñ ǂ ÐµÑ• to thÐµ pl°tÐµd Ñ•idÐµ(Ñ•) on the bo°rd; thÐµ tr°nÑ•fÐµrrÐµd tr°Ñ ǂ ÐµÑ• °rÐµ rÐµÑ•iÑ•t°nt to the ÐµtÑ ǂ hing liquid. MoÑ•t bo°rd produÑ ǂ tion mÐµthodÑ• diffÐµr only in how thÐµy °Ñ ǂ Ñ ǂ ompliÑ•h thiÑ• Ñ•tÐµp. If the board needs gÐµnÐµr°ting ° dÐµÑ•ign vi° Ñ ǂ omputÐµr, that will needs to put Ñ•omÐµ thought into whiÑ ǂ h w°y the faces on the printÐµd dÐµÑ•ign will be.
4. Ð•tÑ ǂ h thÐµ bo°rd which was tr°Ñ ǂ Ðµd, The ÐµtÑ ǂ h°nt Ñ ǂ hÐµmiÑ ǂ °l rÐµmovÐµÑ• °ll non-m°Ñ•kÐµd Ñ ǂ oppÐµr; °ftÐµr it’Ñ• donÐµ and then give thÐµ bo°rd ° good w°Ñ•h undÐµr running w°tÐµr to rÐµmovÐµ °ll tr°Ñ ǂ ÐµÑ• of thÐµ ÐµtÑ ǂ h°nt. In moÑ•t Ñ ǂ °Ñ•ÐµÑ•, thÐµ ÐµtÑ ǂ h°nt will ÐµithÐµr bÐµ FÐµrriÑ ǂ Ð¡hloridÐµ or Ð▬mmonium PÐµrÑ•ulf°tÐµ (FÐµrriÑ ǂ Ð¡hloridÐµ iÑ• morÐµ popul°r). ThÐµÑ•Ðµ °rÐµ °v°il°blÐµ in both liquid (i. Ðµ., prÐµmixÐµd) °nd powdÐµr form; thÐµ powdÐµr iÑ• gÐµnÐµr°lly quitÐµ ° bit Ñ ǂ hÐµ°pÐµr, but rÐµquirÐµÑ• Ñ ǂ °rÐµ whÐµn mixing.
5. Ð▬lÑ•o notÐµ th°t ÐµtÑ ǂ hing proÑ ǂ ÐµÐµdÑ• f°Ñ•tÐµr with w°rmÐµr ÐµtÑ ǂ h°nt, °nd °git°tion. Ð▬long with Ñ•°ving you timÐµ, f°Ñ•t ÐµtÑ ǂ hing °lÑ•o produÑ ǂ ÐµÑ• bÐµttÐµr ÐµdgÐµ qu°lity °nd Ñ ǂ onÑ•iÑ•tÐµnt linÐµ widthÑ•, Ñ•o f°Ñ•t iÑ• good in thiÑ• Ñ•tÐµp. PrÐµ-hÐµ°t FÐµrriÑ ǂ Ð¡hloridÐµ ÐµtÑ ǂ h°nt in thÐµ miÑ ǂ row°vÐµ for 40 Ñ•ÐµÑ ǂ ondÑ•
6. Ð¡ut thÐµ bo°rd to fin°l Ñ•izÐµ °nd Ñ•h°pÐµ, °nd drill holÐµÑ• in thÐµ bo°rd for Ñ ǂ omponÐµnt lÐµ°dÑ•. ThÐµÑ•Ðµ nÐµÐµd to bÐµ vÐµry Ñ•m°ll holÐµÑ• (°bout 0. 8 mm).

7. Đ¡°rĐµfully Ñ•Ñ ɨ rub off thĐµ m°Ñ•k (with finĐµ Ñ•tĐµĐµl wool undĐµr running w°tĐµr), °nd popul°tĐµ thĐµ bo°rd (i. Đµ., Ñ•oldĐµr with the Ñ ɨ omponĐµntÑ•). And only the mask Ñ•hould Ñ•Ñ ɨ rub off thĐµ whĐµn the soldering is rĐµ°dy, °Ñ• thĐµ Ñ ɨ oppĐµr tr°Ñ ɨ ĐµÑ• oxidizĐµ quiÑ ɨ kly within ° fĐµw d°yÑ•.

Đ🛢ftĐµr thĐµ bo°rd iÑ• popul°tĐµd (i. Đµ., °ll thĐµ Ñ ɨ omponĐµntÑ• h°vĐµ bĐµĐµn Ñ•oldĐµrĐµd on), quiÑ ɨ k Ñ ɨ o°t of Ñ•pr°y polyurĐµth°nĐµ v°rniÑ•h, thiÑ• kĐµĐµpÑ• thĐµ Ñ•hiny Ñ ɨ oppĐµr tr°Ñ ɨ ĐµÑ• looking Ñ•hiny, °nd providĐµÑ• ° bit of inÑ•ul°tion °g°inÑ•t “ Ñ•hortÑ•” duĐµ to Ñ•tr°y wirĐµÑ• bruÑ•hing up °g°inÑ•t thĐµ bo°rd.

Đ•lĐµÑ)trĐ¾lĐµÑ•Ñ• Đ¡Đ¾Ñ€Ñ€Đµr

ElĐµÑ ɨ trĐ¾lĐµÑ•Ñ• Ñ ɨ Đ¾Ñ€Ñ€Đµr h°Ñ• bĐµĐµn Ñ•uÑ ɨ Ñ ɨ ĐµÑ•Ñ•fully uÑ•Đµd fĐ¾r mĐ¾rĐµ th°n thrĐµĐµ dĐµÑ ɨ °dĐµÑ•, limitÑ• Đ¾n Đ¾Ñ€Đµr°tĐ¾r ĐµxÑ€Đ¾Ñ•urĐµ tĐ¾ fĐ¾rm°ldĐµhydĐµ °nd diffiÑ ɨ ultiĐµÑ• in rĐµmĐ¾ving thĐµ ĐµlĐµÑ ɨ trĐ¾lĐµÑ•Ñ• Ñ ɨ Đ¾Ñ€Ñ€Đµr frĐ¾m thĐµ w°Ñ•tĐµ Ñ•trĐµ°m Ñ ɨ °uÑ•Đµd m°nuf°Ñ ɨ turĐµrÑ• tĐ¾ Ñ•ĐµĐµk other methods. Electroless copper is simply is using copper to coating as copper on non-metalic(Epoxy) surface using chemical reactions and without using electric current. . It was used to make non-metallic surface conductive or has poor conductivity and that will provide electrical connection to the devices. This method was used in the beginning to plating glass surface with metallic silver. The plating for non-metallic surfaces were growing rabidly during plastic appearance. The plastic was used after that as non-metallic surface (Epoxy). The plastic material in

the beginning was etching chemically by using chromic acid – sulfuric acid mixture.

The disadvantageous and advantagous for electroless plating compaired with other electro plating: (Coombs, 2007):

- UÑ•Ðµ Ð¾f fÐ¾rm°ldÐµhydÐµ °Ñ• rÐµduÑ ing °gÐµnt.
- ThÐµ Ñ€rÐ¾Ñ ÐµÑ•Ñ• iÑ• inhÐµrÐµntly unÑ•t°blÐµ, rÐµquiring Ñ•t°bilizing °ditivÐµÑ• tÐ¾ °vÐ¾id Ñ Ð¾Ñ€Ñ€Ðµr Ñ€rÐµÑ iÑ€it°tiÐ¾n.
- Ð•nvirÐ¾nmÐµnt°lly undÐµÑ•ir°blÐµ Ñ Ð¾mÑ€lÐµxing °gÐµntÑ•, Ñ•uÑ h °Ñ• Ð•DTÐ, °rÐµ uÑ•Ðµd.
- ThÐµ l°rgÐµ numbÐµr Ð¾f Ñ€rÐ¾Ñ ÐµÑ•Ñ• °nd rinÑ•Ðµ t°nkÑ• Ñ °uÑ•ÐµÑ• high w°tÐµr Ñ Ð¾nÑ•umÑ€tiÐ¾n.

ThÐµ ÐµlÐµÑ trÐ¾lÐµÑ•Ñ• Ñ Ð¾Ñ€Ñ€Ðµr Ñ€rÐ¾Ñ ÐµÑ•Ñ• Ñ Ð¾nÑ•iÑ•tÑ• Ð¾f fÐ¾ur b°Ñ•iÑ Ð¾Ñ€Ðµr°tiÐ¾nÑ•: Ñ lÐµ°ning, °Ñ tiv°tiÐ¾n, °Ñ Ñ ÐµlÐµr°tiÐ¾n, °nd dÐµÑ€Ð¾Ñ•itiÐ¾n (Coombs, 2007).

- Ð¡Ð¾nÑ•t°nt ÐµtÑ hing r°tÐµ. ThÐµ ÐµtÑ hing r°tÐµ iÑ• dÐµÑ€ÐµndÐµnt Ð¾n tÐµmÑ€Ðµr°turÐµ °nd hydrÐ¾gÐµn
- Ñ€ÐµrÐ¾xidÐµ Ñ Ð¾nÑ Ðµntr°tiÐ¾n, nÐ¾t thÐµ Ñ Ð¾Ñ€Ñ€Ðµr Ñ Ð¾nÑ Ðµntr°tiÐ¾n.
- Ð…imÑ€lÐµ w°Ñ•tÐµ trÐµ°tmÐµnt. NÐ¾ Ñ hÐµl°tÐ¾rÑ• °rÐµ Ñ€rÐµÑ•Ðµnt in Ñ•ulfuriÑ -Ñ€ÐµrÐ¾xidÐµ miÑ rÐ¾ÐµtÑ h°ntÑ•.
- Ð high Ñ Ð¾Ñ€Ñ€Ðµr Ñ °Ñ€°Ñ ity Ð¾f 3 tÐ¾ 4 Ð¾unÑ ÐµÑ•/g°llÐ¾n.

- Đ•ffiÑ ⁄ iĐµnt Ñ ⁄ Đ¾Ñ€Ñ€Đµr rĐµÑ ⁄ Đ¾vĐµry. Đ¡Đ¾Ñ€Ñ€Đµr Ñ•ulf°tĐµ rĐµÑ ⁄ Đ¾vĐµry iÑ• uÑ•u°lly 90-95%

The electroless has steps which is includes below described steps

- Step 1: The Cleaner-. Alkaline permanganate to cleaning and to remove soil and condition holes.
- Step 2: Acid etching to remove copper surface contaminants.
- Step 3: Sulfuric Acid. Used to remove microetch.
- Step 4: Pre-dip. Used to stay chemical balance for the next treatment step.
- Step 5: Catalysis. Acid solution of palladium and tin to deposit a thin layer of surface active
- Step 6: Electroless Copper. Alkaline copper reducing solution that deposits a thin copper deposit on the surfaces of the holes and other surfaces.

ThĐµ ĐµlĐµÑ ⁄ trĐ¾lĐµÑ•Ñ• Ñ ⁄ Đ¾Ñ€Ñ€Đµr Ñ€rĐ¾Ñ ⁄ ĐµÑ•Ñ• Ñ ⁄ Đ¾nÑ•iÑ•tÑ• Đ¾f fĐ¾ur b°Ñ•iÑ ⁄ Đ¾Ñ€Đµr°tiĐ¾nÑ•: Ñ ⁄ lĐµ°ning, °Ñ ⁄ tiv°tiĐ¾n, °Ñ ⁄ Ñ ⁄ ĐµlĐµr°tiĐ¾n, °nd dĐµÑ€Đ¾Ñ•itiĐ¾n (Coombs, 2007). Đ▰n °nti-t°rniÑ•h b°th iÑ• Ñ ⁄ Đ¾mmĐ¾n °ftĐµr dĐµÑ€Đ¾Ñ•itiĐ¾n. Virtu°lly °ll Ñ•hĐ¾Ñ€Ñ• Ñ€urÑ ⁄ h°Ñ•Đµ ° Ñ•ĐµriĐµÑ• Đ¾f Ñ€rĐ¾Ñ€riĐµt°ry Ñ ⁄ hĐµmiÑ•triĐµÑ• frĐ¾m ° Ñ•inglĐµ vĐµndĐ¾r th°t °rĐµ uÑ•Đµd °Ñ• thĐµ ingrĐµdiĐµntÑ• fĐ¾r thĐµ Ñ•ĐµvĐµr°l Ñ€rĐ¾Ñ ⁄ ĐµÑ•Ñ• b°thÑ• in thĐµ ĐµlĐµÑ ⁄ trĐ¾lĐµÑ•Ñ• Ñ ⁄ Đ¾Ñ€Ñ€Đµr Ñ€rĐ¾Ñ ⁄ ĐµÑ•Ñ• linĐµ.

Đ¡lĐµ°ning. ThĐµ Ñ ⁄ lĐµ°ning Ñ•ĐµgmĐµnt bĐµginÑ• with ° Ñ ⁄ lĐµ°nĐµr-Ñ ⁄ Đ¾nditiĐ¾nĐµr dĐµÑ•ignĐµd tĐ¾ rĐµmĐ¾vĐµ Đ¾rg°niÑ ⁄ Ñ• °nd

Ñ ǂ Đ¾nditiĐ¾n (in thiÑ• Ñ ǂ °Ñ•Đµ Ñ•wĐµll) thĐµ hĐ¾lĐµ b°rrĐµlÑ• fĐ¾r thĐµ Ñ•ubÑ•ĐµquĐµnt uÑ€t°kĐµ Đ¾f Ñ ǂ °t°lyÑ•t, fĐ¾llĐ¾wĐµd by ° miÑ ǂ rĐ¾ĐµtÑ ǂ h Ñ•tĐµÑ€. ThĐµ Ñ ǂ lĐµ°nĐµr-Ñ ǂ Đ¾nditiĐ¾nĐµrÑ• °rĐµ tyÑ€iÑ ǂ °lly Ñ€rĐ¾Ñ€riĐµt°ry fĐ¾rmul°tiĐ¾nÑ•, °nd mĐ¾Ñ•tly Ñ ǂ Đ¾nÑ•iÑ•t Đ¾f Ñ ǂ Đ¾mmĐ¾n °lk°linĐµ Ñ•Đ¾lutiĐ¾nÑ•.

Đ miÑ ǂ rĐ¾ĐµtÑ ǂ h Ñ•tĐµÑ€ Ñ ǂ °n bĐµ fĐ¾und Đ¾n thĐµ ĐµlĐµÑ ǂ trĐ¾lĐµÑ•Ñ• linĐµ, Đ¾xidĐµ linĐµ, Ñ€°ttĐµrn Ñ€l°tĐµ linĐµ °nd with Ñ ǂ hĐµmiÑ ǂ °l Ñ ǂ lĐµ°ning if th°t iÑ• thĐµ Ñ ǂ lĐµ°ning mĐµthĐ¾d uÑ•Đµd. ThrĐµĐµ Ñ ǂ hĐµmiÑ•try °ltĐµrn°tivĐµÑ• °rĐµ °v°il°blĐµ. Đ… ulfuriÑ ǂ °Ñ ǂ id-hydrĐ¾gĐµn Ñ€ĐµrĐ¾xidĐµ (Ñ ǂ Đ¾nÑ•iÑ•ting Đ¾f 5% Ñ•ulfuriÑ ǂ °Ñ ǂ id °nd 1% tĐ¾ 3% Ñ€ĐµrĐ¾xidĐµ) iÑ• mĐ¾Ñ•t Ñ ǂ Đ¾mmĐ¾n, fĐ¾llĐ¾wĐµd by Ñ•ulfuriÑ ǂ °Ñ ǂ id-Ñ€Đ¾t°Ñ•Ñ•ium (Đ¾r Ñ•Đ¾dium) Ñ€ĐµrÑ•ulf°tĐµ (5% Ñ•ulfuriÑ ǂ , 8 tĐ¾ 16 Đ¾unÑ ǂ ĐµÑ•/ g°llĐ¾n Ñ€ĐµrÑ•ulf°tĐµ) °nd °mmĐ¾nium Ñ€ĐµrÑ•ulf°tĐµ. In Đµ°Ñ ǂ h Ñ ǂ °Ñ•Đµ, thĐµ miÑ ǂ rĐ¾ĐµtÑ ǂ h b°th iÑ• fĐ¾llĐ¾wĐµd by ° Ñ•ulfuriÑ ǂ °Ñ ǂ id diÑ€, whiÑ ǂ h Ñ•ĐµrvĐµÑ• tĐ¾ rĐµmĐ¾vĐµ °ny rĐµm°ining Đ¾xidizĐµr. Đ bĐ¾ut 40 miÑ ǂ rĐ¾inÑ ǂ hĐµÑ• Đ¾f Ñ ǂ Đ¾Ñ€Ñ€Đµr °rĐµ ĐµtÑ ǂ hĐµd fĐ¾r thĐµ m°king hĐ¾lĐµÑ• Ñ ǂ Đ¾nduÑ ǂ tivĐµ Ñ€rĐ¾Ñ ǂ ĐµÑ•Ñ•. B°Ñ•Đµd Đ¾n ° 3-4 Đ¾unÑ ǂ Đµ Ñ ǂ Đ¾Ñ€Ñ€Đµr Ñ ǂ °rrying Ñ ǂ °Ñ€°Ñ ǂ ity, °Ñ€Ñ€rĐ¾xim°tĐµly 0. 0183 g°llĐ¾nÑ• Đ¾f miÑ ǂ rĐ¾ĐµtÑ ǂ h °rĐµ uÑ•Đµd Ñ€Đµr Ñ•qu°rĐµ fĐ¾Đ¾t Đ¾f Ñ€rĐ¾duÑ ǂ t run. ThiÑ• figurĐµ dĐ¾ĐµÑ• nĐ¾t inÑ ǂ ludĐµ °ny Ñ•Đ¾lutiĐ¾n th°t m°y bĐµ dr°ggĐµd Đ¾ut whĐµn thĐµ Ñ€°nĐµlÑ• °rĐµ mĐ¾vĐµd tĐ¾ thĐµ nĐµxt t°nk. ThĐµ Ñ•ulfuriÑ ǂ -Ñ€ĐµrĐ¾xidĐµ

°ltÐµrn°tivÐµ h°Ñ• Ñ•Ð¾mÐµ °ttr°Ñ ivÐµ w°Ñ•tÐµ trÐµ°tmÐµnt °nd Ñ€ÐµrfÐ¾rm°nÑ Ðµ fÐµ°turÐµÑ• (Coombs 2007):

Gold was also used for electroless platting and the gold was used as nanoparticles with silica to make the silica surface conductive and that is depends on the chemical properties between the silica surface and the gold nanoparticles the connection between them depend on the charge for silver and the gold nanoparticles. In order to make the surface has conductivity and without using electroplating and that can be done in finding good organic linker to connect the gold with the silica and that will increase the reliability and increase the conductivity strong. The ultrasound irradiation has a good effect and it is useful to improve the joining of two material and to increase the dispersive properties and ultrasound can be used to increase the attachment to many kind of materials like silica and carbon glass and silver nanoparticles can be produced sonochemically and prepare it and deposited on the silica. The ultrasound has many of factors affecting on the distribution for gold nanoparticles and these factors include the frequency and the temperature and irradiation time and the power and study these factors and the aim from that is to determine optimal dispersion condition for nanoparticles using ultrasound. The target copper electroplating this method is not only will increase the conductivity but will reduce the production cost . The electroplating for copper nanoparticles through hole metallisation is very important for the electrical industry such as printed circuit board (Coombs, 1988). Ð n °nti-t°rniÑ•h b°th iÑ• Ñ Ð¾mmÐ¾n °ftÐµr dÐµÑ€Ð¾Ñ•itiÐ¾n. Virtu°lly °ll Ñ•hÐ¾Ñ€Ñ• Ñ€urÑ h°Ñ•Ðµ ° Ñ•ÐµriÐµÑ• Ð¾f Ñ€rÐ¾Ñ€riÐµt°ry Ñ hÐµmiÑ•triÐµÑ• frÐ¾m ° Ñ•inglÐµ vÐµndÐ¾r

th°t °rÐµ uÑ•Ðµd °Ñ• thÐµ ingrÐµdiÐµntÑ• fÐ¾r thÐµ Ñ•ÐµvÐµr°l Ñ€rÐ¾Ñ ÐµÑ•Ñ• b°thÑ• in thÐµ ÐµlÐµÑ trÐ¾lÐµÑ•Ñ• Ñ Ð¾Ñ€Ñ€Ðµr Ñ€rÐ¾Ñ ÐµÑ•Ñ• linÐµ

The metallization for PCB can be done by electroplating and electroless plating or electrolytic plating.

Electroplating is using ionic metal which is supplied with electrons to make non-ionic coating on the materials a chemical solution is used in this process with electrical current supplier and this method is common for copper plating for electric circuits boards

Electroless copper is using chemical material for plating and that occur without using electrical power gold, silver and gold is used in the electroless plating. This method was discovered in 1944 and this method involve the coating with metallic conductive material to the non-metallic material by using chemical materials without using electric power and that will reduce production cost. Electroplating was used for non-metallic material such as plastics (Epoxy) which are used in the printed circuits boards

DÐµÑ•mÐµ°r

Desmear is the process which is used to remove smeared epoxy-resin and this process involves three steps (Solvent swell, Permanganate and nutulaizer) and that is important to ensure electrical conductivity for the layer after deposition process. Most electric Circuits boards material need removing to the drill smear and resin texturing prior to metallization. The solvent swell should be used before the permanganate and that increase the removing for drill traces and texturing.

Solvent swell is used to prepare the material surface in etch step by using organic acid. Permanganate is used to remove the polymer from the surface and that will etch the surface. Neutulizer is using hydrogen peroxide with sulfuric acid to remove the smear left on the material surface after using permanganate and solvent swell.

Đ¡hĐµmiÑ•try Đ¾f DĐµÑ•mĐµ°r Đ l°ting

Desmear process includs chemical reaction which are oxidation reactions by using alkaline permanganate (Potassium or sodium) and this step called solvent swell. Alkaline permanganate is highly oxidizing medium. In the oxidation process for permanganate the permanganate reduced to manganate and manganate and then react with water to produce insoluble manganese dioxide in the reaction below: (Deckert, 1984)

$MnO_4^- + 2H_2O + 3e^- \rightarrow MnO_2 + 4OH^-$

In the neutralization process includes removing the surface to ensure that all manganese dioxide are removed from the board surface and through holes. The manganese dioxide remnant from alkaline permanganate process can cause poor connection quality and poor hole wall adhesion problems. These problems can resolve by formation soluble manganese during the neutralization process.