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Kata-Kata Aluan

PENGARAH KAMPUS UITM PERLIS

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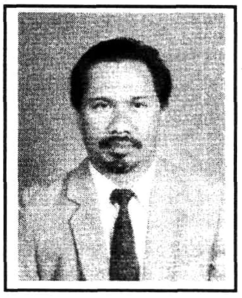

Kata-Kata Aluan

KETUA UNIT PENYELIDIKAN DAN PERUNDINGAN (UPP) UiTM PERLIS

Assalamualaikum Warahmatullahi Wabarakatuh

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KERTAS
KONSEP

A STUDY ON ELECTROPLATING

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ABSTRACT

Electroplating is one of the process that is used in the semiconductor industry to prevent base metal from oxidation and to provide an easily solderable surface for soldering of component onto printed circuit board. The problem in electroplating is studied and the optimum parameter to yield the quality product is the main purpose of this study. The result shows that a substantial improvement can be achieved by the standard parameter.

KEYWORDS
Metal, electroplating

INTRODUCTION

The aim of this study is to analyse the solderbility failure for small outlined intergrated circuit. The exact failure is that the small outlined intergrated circuit is not available to solder on the printed circuit board. Propose that the problem is either caused from honing or plating process. This study concentrated on plating process.

THEORY

ELECTROPLATING

Plating is the process of depositing a coating having a desirable form by means electrolysis. Conduction in liquids differs from conduction in solids in these ways;

1. In a liquid there are no individually free electrons, as there are in metal wire. Elements that have atoms with one, two or three electrons in the outmost shell are called metal.
2. Conduction in a liquid is a two ways movement of charged ions, which are much bigger than electrons. Positive ions drift toward the negative wire, negative ions at the same time are attracted toward the positive wire. This movement is the electric current in the liquid.

The opposite movement of the ions separates the two parts of the originally dissolved compound, this electrical separation is called electrolysis. Any conducting liquid is called an electrolyte. The term cathode is given to the electrode terminal where electrons enter a device. The anode is the electrode where they leave.

Electroplating is most often carried out for the purpose of enhancing the appearance, ability to withstand corrosive agent, resistance to abrasion or other desired properties or a combination of them, although occasionally it is used simply to alter dimensions.

In any plating process, copper, silver, nickel etc, the solution must contain ions of the metal that is to form the coating. In this case, tin and lead are used as the metal compound. Plating solutions contain other ingredients such as solder on acid for conductivity, sg makeup to prevent corrosion and additive as wetting agent.

Metals ions are all positive so the object to be plated is connected to the negative wire. The positive terminal is usually made of the same metal that is to form the coating. In this experiment, the positive terminal is made of copper and brass. The solder anodes are made of 85% tin and 15% lead. The object to be plated, must be an electrical conductor but need not be of metal, since the surface can be made conductivity by graphite, painted on as a suspension known as aquadaq, or by silver deposited by chemical reaction. This procedure permits the electroplating of plaster, plastic, wax, wood etc.

The best constitution of plating bath, its temperature, pH and other factors are often determined by experiment. Thorough removal of grease, dirt and oxide films from the surface is always essential. Electroplating aims at producing an electrolytic deposit which is as constant in thickness as possible over the whole of the treated surface, is smooth, regular and very adherent to the support, nonporous and of the most compact structure possible with a very fine crystalline grain; foreign inclusions and surface defects as cracks and pinholes must be absent.

HONING

The purposes of honing are to remove flash and bleed on the lead frame and to prepare the package surface for marking. There are four parameters for honing, type of honing media, honing pressure, media concentration and belt speed. There are three types of honing media, Fuji bright 1505(Japan), potter media (MS-ML) from Pan Abrasive (Austria) and NESP Media (NE-ML13) from Abrasive Engineering (USA). During the honing process, these parameters are important to identify the quality of honing. The type of media will effect the materials either it will become rough or soft. The depth of the materials after the honing process depends on the pressure and the speed of the belt. The pressure is proportionate to the depth but the speed is not proportionate to the depth.

APPARATUS & EQUIPMENT

Atomic Absorption Spectrophotometer model 2280, UV Spectrophotometer model PU8620, X-ray machine, pipettes 5ml, 10ml, 25ml, volumetric flask 100ml, 250ml, 500ml, 1000ml, pyrex beaker 100 ml, 250 ml, burette 25 ml, conical flask 250 ml and measuring cylinder 50 ml, 100 ml.

EXPERIMENTAL PROCEDURES

The specimen used was a strip of intergrated circuit. Figure 1 shows the electroplating procedures. Figure 2 shows the electroplating bath.

PROCESS STEPS FOR ELECTROPLATING

1. Racking; to load the strips to the racks.
2. Citric acid; its ph is between 1-1.5 similar to the ph of food juice, eg orange juice. The acid etch away tarnish surface of strip to exchange adhesion of solder.
3. Acid DI rinse; to dilute any acid residue carry over. Process affected: low flowrate, short immersion time, short drip time result in excessive drag over acid residue into plating bath, prolong soaking time result in clean surface become tarnish again.
4. Plating; to plate the strips with solder and lead.
    - Plating current;
        1. Tin has preference over lead at low current density region and it will cause low solder thickness, rich in tin.
        2. Lead has preference over tin at high current density region and this will result in high solder thickness, rich in lead.
    - Plating time

APPENDIX

CHEMICAL ANALYSIS

PROCESS CONTROL

1. Quality controller will check solder thickness using SFT7000 & SFT7100 XRF coating thickness gauge (x-ray machine) and will plot statistical process control charts for every shift. Two strips will be taken from each lot for certain plating tank to check the solder thickness.
2. Chemical analysis will be done by quality controller daily, (monday to friday) to adjust the plating tanks.
3. Operators will check the parameters daily at 8.00 am.
4. Solderbility test will be held at solderbility test lab by quality controller using certain sample size, for every shift.
5. Preventive maintenance will be done weekly by technicians.

1. ATOMIC ABSORPTION SPECTROPHOTOMETER

OBJECTIVE:

Atomic absorption spectrophotometer is used to analyse the concentration of lead (Pb) and the percentage of lead complexing agent (sg makeup).

CALCULATION OF CHEMICAL CONCENTRATION

1. Lead concentration
   Lead concentration = (A sample × 2.5)/A standard)
2. Percentage of lead complexing agent (sg makeup)
   - Sodium content + Na(ppm) = (A sample × 0.5 × 5000)/A standard.
   - % sg makeup = (ppm Na × 0.0024) – 0.72

   A sample = Atomic absorbance of sample
   A standard = Atomic absorbance of standard

SPECIFICATION:

For lead the value is between 1.2-4.0
For make up the value is between 4.0-10.0

CONTROL LIMITS:

For sg makeup the value is 5.0 but lead does not have a specific value. Lead concentration will change when the other ingredients are added.

2. TITRATION

OBJECTIVE:

To analyse the concentration of stannous tin and the percentage of solder on acid.

CALCULATION OF CHEMICAL CONCENTRATION

1. Concentration of stannous tin (Sn)

Concentration of stannous tin = 1.187 × volume of iodine used (g/liter)

2. Percentage of solder on acid

   %SOA = volume of NaOH × 1.4

3. Concentration of citric acid

   Concentration of citric acid = volume of NaOH × 6.4 (g/liter)

SPECIFICATION:

For tin the value is (11.5-15.5), for SOA is (18.6-23.0) and for citric acid is (50-60)

CONTROL LIMITS:

For tin the value is 13.3, for SOA is 20.8 and for citric acid if the value is less than 50 adjustment should be made until the reading is between (50-60) but if the value is above 60 adjustment should not be made.

3. UV SPECTROPHOTOMETER

OBJECTIVE:

To analyse the percentage of additive content.

CALCULATION OF CHEMICAL CONCENTRATION

Percentage of additive content

1. Cumulative % tin

   $$Cum = \{[C \times (V-R)\} + [100 \times A]\}/V$$

   Cum = % cumulative tin for the day of interest
   C = % cumulative tin for the previous analysis
   V = Volume of the bath (347 liters)
   R = Volume of solution removed
   A = Volume of tin concentrate added

2. % Additive = {[50× Absorbance] – [Cum × 0.62]}/0.67

SPECIFICATION:

It value is (9.0 – 13.0)

CONTROL LIMITS:

It value is 12.6

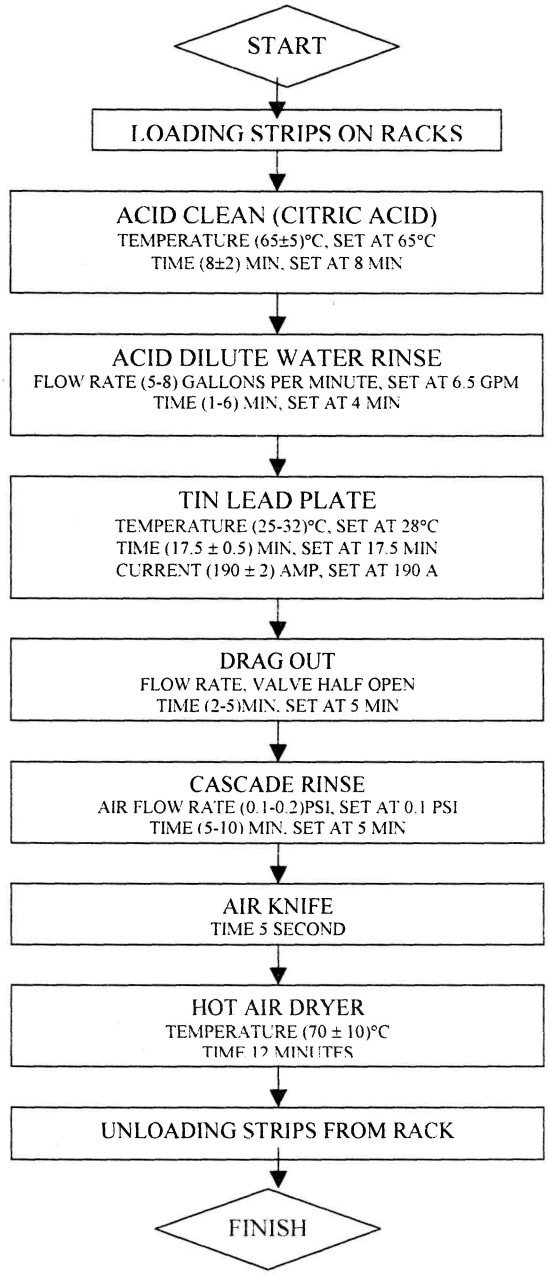
START
LOADING STRIPS ON RACKS
ACID CLEAN (CITRIC ACID)
TEMPERATURE (65±5)°C, SET AT 65°C
TIME (8±2) MIN, SET AT 8 MIN
ACID DILUTE WATER RINSE
FLOW RATE (5-8) GALLONS PER MINUTE, SET AT 6.5 GPM
TIME (1-6) MIN, SET AT 4 MIN
TIN LEAD PLATE
TEMPERATURE (25-32)°C, SET AT 28°C
TIME (17.5 ± 0.5) MIN, SET AT 17.5 MIN
CURRENT (190 ± 2) AMP, SET AT 190 A
DRAG OUT
FLOW RATE, VALVE HALF OPEN
TIME (2-5)MIN, SET AT 5 MIN
CASCADE RINSE
AIR FLOW RATE (0.1-0.2)PSI, SET AT 0.1 PSI
TIME (5-10) MIN, SET AT 5 MIN
AIR KNIFE
TIME 5 SECOND
HOT AIR DRYER
TEMPERATURE (70 ± 10)°C
TIME 12 MINUTES
UNLOADING STRIPS FROM RACK
FINISH

Figure 1. The flow chart for the electroplating process.

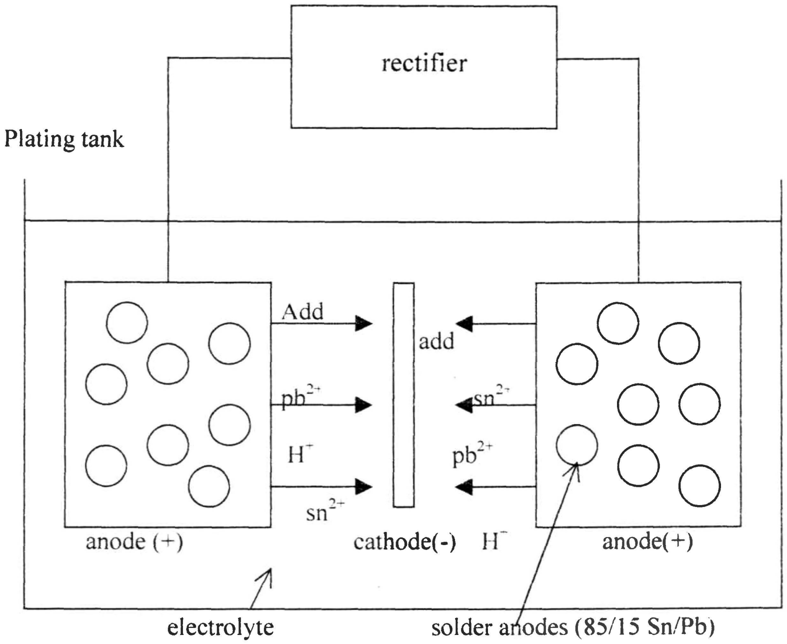

Figure 2. Schematic of the plating tank.

Electrolyte composition; tin ion(Sn^{2+}), lead ion(Pb^{2-}), acid(H^+), additive(add).
Acid; to improve conductivity of plating tank.
Additives; consists of grain refiner, antioxidant, wetting agent.
At anode: $Sn - 2e \rightarrow Sn^{2-}$; $Pb + 2e \rightarrow Pb^{2+}$
At cathode: $Sn^{2+} + 2e \rightarrow Sn$; $Pb^{2+} + 2e \rightarrow Pb$