
UPORABA PLAZME V ELEKTRONIKI APPLICATION OF PLASMA IN ELECTRONICS

PLASMA PROCESSES

PART II : APPLICATIONS IN ELECTRONICS

I. Šorli*, W. Petasch, B. Kegel, H. Schmid, G. Liebel, W. Ries

*MIKROIKS d.o.o., Ljubljana, Slovenia

Technics Plasma GmbH, Kirchheim, Germany

1.0 INTRODUCTION

Plasma is obtained by producing a discharge in gases or gas mixtures under vacuum through the application of high frequency alternating voltage. The gas in the chamber is brought to an excited (ionized) state. As well, active radicals and UV radiation are released. Electrons and UV light, resulting from the recombination processes are essential for maintaining the plasma. These components are the actual energy carriers, which are ultimately responsible for the production of chemically active radicals. This highly active process gas is capable of reacting with the surface of the material to be treated even at low temperatures. During the process fresh gas is continuously fed into the chamber. The reaction products are evacuated by the vacuum pump.

Plasma excitation via microwaves (2.45 GHz) has proved especially effective, since the efficiency of the gas discharge increases considerably with increasing frequency but still requiring very low electrical power. This results in strong, intensive ionization and production of radicals and thus a more cost effective process. Today's microwave excitation technology makes it possible to use the low pressure plasma processes economically in industrial mass production in either continuous or batch systems using large process chambers. Small bulk parts, as well as large components can be effectively cleaned and activated.

Very important issue of low pressure plasma is its penetrability. The gas enters the smallest crevices, making it possible to process three - dimensional parts with complex geometries. Another very important fact is that plasma processes are environmentally friendly and as such are alternatives to CFC cleaning processes.

Thus, main advantages of low-pressure plasma technology are:

- dry process
- energy saving through low power consumption
- inexpensive supplies, cost - effective gases
- switch - off chemistry: the process stops immediately when the power is turned off, no disposal of waste

- cleaner, safer workplace, simple operation
- high penetration power into narrow spaces - an advantage in degreasing or activating parts with complex shapes
- constant process conditions, good reproducibility
- meets or exceeds air emission standards
- parts are absolutely dry after treatment

2.0 SUPER FINE CLEANING WITH LIQUID PHASE PRECLEANING AND SUBSEQUENT PLASMA TREATMENT

2.1 GENERAL

Cleaning and degreasing is a widely used industrial procedure. Stricter environmental requirements and recently discovered facts regarding the effect of previously used cleaning and drying agents on atmosphere chemistry make a radical review of the conventional cleaning technologies necessary.

The plasma process is especially well suited for removing organic contaminants and residual films (such as greases, oils, waxes or solvents) when the films are very thin and super clean surfaces are required. A very important characteristic of low pressure plasma is its penetrating power. The gas penetrates into small pores that are difficult or impossible for liquids to access. Thus, even parts with complex shapes can be easily processed with plasma (cutouts, small radii, bore holes, slots). The penetration capability allows the plasma to reach even cracks with micrometric dimensions.

Since most cleaning problems are concerned with the removal of organic substances from the surface, oxygen is used in most cases as the reactive gas. Oxygen is so one of the most important process gases in the treatment of almost all types of materials, In the case of polymer activation which is discussed in Part III, best results are achieved with oxygen for the most common polymers.

Mechanical abrasion through particle bombardment (sputtering effect) has a subordinate role in the type of equipment used for this purpose.

The effect of oxygen is enhanced by the admixture of small amounts (five to ten percent) of argon or helium. Slightly preheating the parts to between 80 and 100°C, whenever the material to be treated allows, is also helpful.

Since the process gas immediately returns to its original state after the gas discharge has been shut off, possible residues capable of causing long term corrosion represent no problem.

Plasma cleaning means that organic impurities are removed by chemically transforming them in volatile products CO, CO₂ and H₂O, figure 1. In short, the process is a dry one, no submerging of the parts into a liquid takes place and energy cost for a separate drying phase can be saved.

Thus, when oxygen is used the cleaning effect consists of oxidative conversion of the organic contaminants.

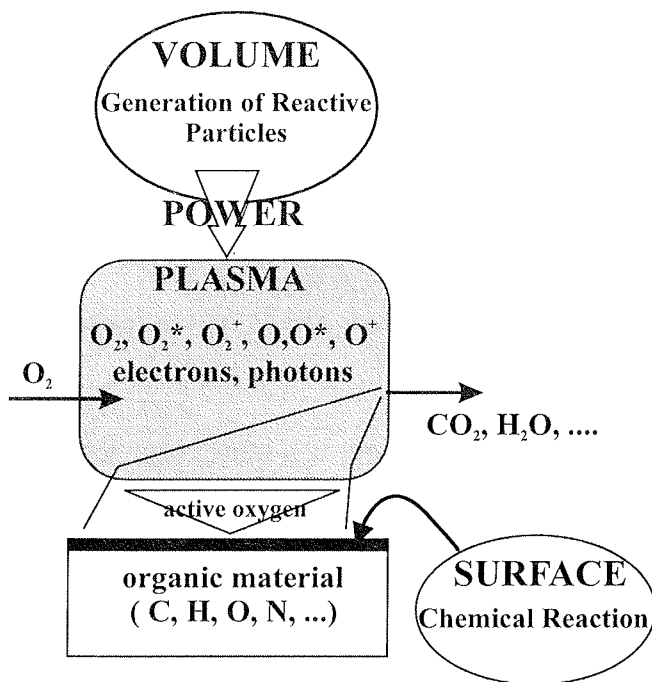


Figure 1: Oxygen plasma cleaning principle

2.2 ENVIRONMENTAL PLUSES TO PLASMA

The plasma process does not use acids, lyes, solvents or liquid halogenated hydrocarbons. The reaction with the process gas takes place in hermetically sealed chambers. For operation, this means no disposal problems and clean workplace conditions, since no poisonous gases or vapors are produced and no hazardous liquids are handled. A plasma system can be easily operated by semi - skilled personnel. The process is simple and does not require special education. Waste gas emissions satisfy and exceed TA clean air standards. There is no fire or explosion hazard.

2.3 DOWNSIDE TO PLASMA

Critical examination discloses the following limitations of this process:

1. Intensive contamination is always irregularly distributed. Thus, the treatment period is long.
2. Photochemical reactions within the surface layer may lead to a crosslinking reaction of the layer material which results in a reduction in the etching rate.
3. Inorganic components (machining chips, debris and other particles) cannot be removed. They tend to form non-volatile oxides or salts remaining on the surfaces.

A solution is provided by a precleaning step, in which the inorganic components are removed and the processing agent amounts are reduced. This leaves a relatively uniform residual layer, which can be removed by means of plasma in a few minutes.

2.4 PRECLEANING WITH DIFFERENT MEDIA

As discussed above, precleaning may be required depending on the initial conditions. The medium used for preclean, the material to be cleaned and the chemical composition of the contamination have an influence on the results of the subsequent plasma cleaning. In the following example, solvent in the form of glycol ether and water, are used as cleaning agents. The part must be dry prior to plasma fine cleaning.

Plant design with the respective peripherals (distilling unit, water treatment and purification) are shown in figure 2.

Examples and Results of Cleaning Procedures

Application:

Degreasing of metallic parts

Case Description:

Cleaning of brass, aluminum and steel parts prior to assembly

Cleaning requirements:

Minimum grease level (low residue carbon)

Former cleaning process:

Aqueous and CFC

Alternative solution:

Aqueous precleaning and final plasma cleaning.

Results showing residual carbon (mg/cm²) left after cleaning are presented in table 1.

TABLE 1

Material	Aqueous Cleaning	Aqueous + Tri	Aqueous + Plasma
X12CrNiS188	29.3	6.8	2.7
CuZn39Pb3	20.7	5.3	3.5
AlCuMgPb	19	7.5	3.7

Additionally, the good cleaning results are confirmed by quantitative measurements of the adhesion of the cleaned parts, table 2. Test setup: copper tube with 3 mm diameter, glued into an aluminum block, both suitably cleaned; glue used: Gupalon 30, setting for four hours at 120°C

TABLE 2

Cleaning method	Tear Strength (N)
Aqueous	531
Aqueous + Tri	642
Aqueous + Plasma	785

- Parts:** Injection molded and stamped parts
- Material:** Non-ferrous metals, silver, plastic
- Contamination:** stripping agents, stamping and bending oils, flux
- Cleaning agent:** Glycol ether (Zestron LP)
- Water:** demineralized, continuously recirculating
- Cleaning requirements:** visually spotless, greaseless, low electrical resistance, imprintability
- Capacity/cycle time:** process - dependent
- Batches:** 40 x 50 x 20 cm perforated baskets

Floorspace required: approx. 40 m²
Installed power: 65 kW

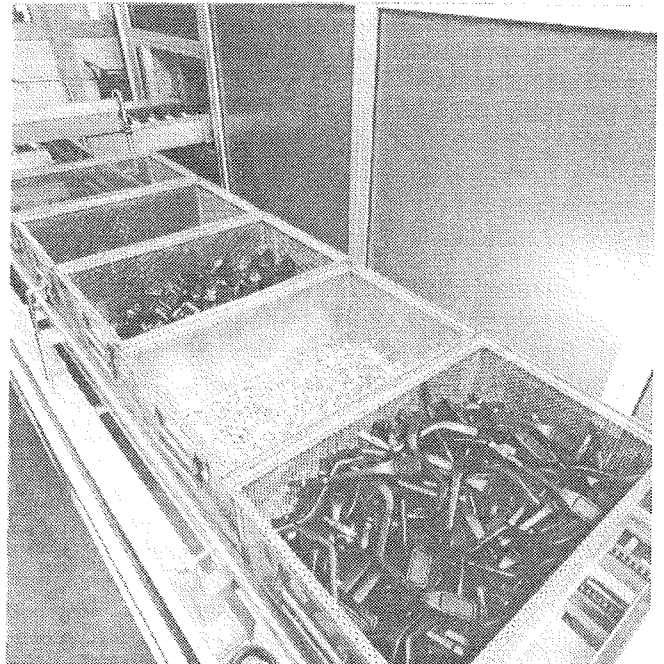
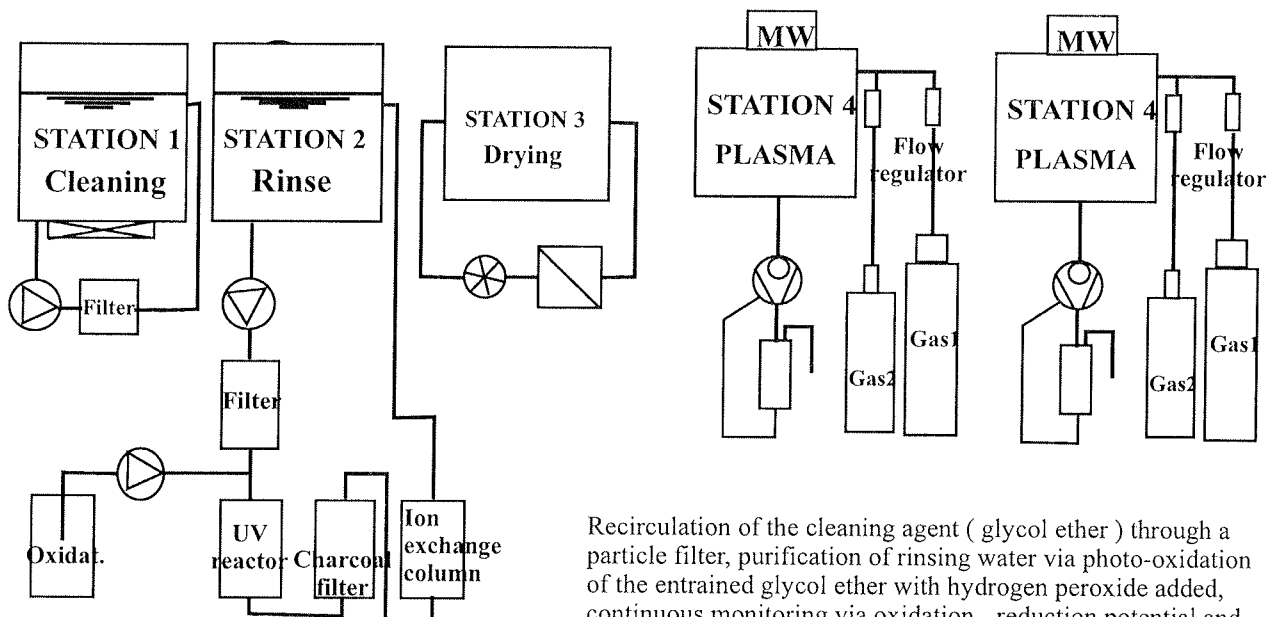


Figure 3: Combination wet/plasma cleaning of metal and plastic parts for the automotive industry

Combination solvent/water and plasma treatment



- 1st stage : Cleaning - dipping with ultrasound(glycoether)
- 2nd stage : Cleaning - rinsing (DI water)
- 3rd stage : Drying in a forced-air oven, at 70 deg.C
- 4th stage : Oxygen plasma cleaning

Recirculation of the cleaning agent (glycol ether) through a particle filter, purification of rinsing water via photo-oxidation of the entrained glycol ether with hydrogen peroxide added, continuous monitoring via oxidation - reduction potential and conductivity measurement after ion exchange, temperature control in furnace, totally enclosed with central exhaust system, automatic handling, automatic process control. Other process versions are possible (e.g. plasma only, aqueous precleaning and plasma, precleaning only, etc.)

Figure 2: Combination of solvent/water and plasma treatment

3.0 APPLICATION OF PLASMA TECHNOLOGY IN ELECTRONIC PACKAGING

Prohibition of CFC's and, in addition increasing surface quality requirements make new solutions for electronic board cleaning necessary. As well, plasma applications of great interest are metal finishing prior to fluxless soldering, device cleaning for reliable wire bonding and surface treatment for adhesive bonding.

3.1 WIRE BONDING ON CRITICAL SURFACES

The yield of plasma treatment is demonstrated by comparative experiments with and without plasma pre-treatment. Parameters of practical significance such as the strength of wire bonds are used as evaluation criteria.

In particular, for bonding wires to printed circuit board substrates, bonding to the connection metal platings is a frequent source of problems. In addition to the inhomogeneity of the circuit board's matrix structure, the quality of the bond pad surface is a frequent cause of failures. Preceding process steps such as soldering and adhesive bonding cause organic contamination, which may precipitate on the bond pads, e.g. in the chip - on - board (COB) technology. With the introduction of a plasma process, prior to bonding wet chemical cleaning can be completely omitted.

Wire bonds are characterized using strength tests such as the pull test according to MIL-STD 883D. Then a metallographic ground cross section of a wire bond is prepared in order to make the joint area visible.

Mechanical Strength Test: Pull Test

The destructive pull test (MIL - STD 883D, Method 2011) is a standard test for determining the strength and reliability of wire bonds. The wire bridge is pulled with a hook under the effect of a continuously increasing pulling force until rupture. The maximum force is measured, making sure that the individual measurements are reproducible.

When evaluating the pull test, one should basically distinguish between different rupture characteristics or failure modes. We distinguish between the failure modes of bond detachment from metallization and wire rupture in the deformation zone.

The different qualities of substrate surfaces can affect bond detachment, but also influence the introduction of ultrasonic energy in the bond, which leads to different kinds of wire deformation at the bond with the resulting effects on wire strength in the heel area.

In figure 4 possible failure modes in the pull test are shown.

A, B: Failure in bond at interface between wire and metallization (bond detachment), 1st or 2nd bond

E, F: Wire rupture at the bond heel, 1st and 2nd bond

H: Bond failure: no bond was made

Well defined contamination of the bond surfaces

Laboratory tests were performed with well defined contamination on bond surfaces.

Surface: Chemically deposited Ni/Au on FR4 substrate.

Bonding process: Ultrasonic wedge bonding with 25 μm AlSi1 wire.

In order to investigate the effectiveness of a plasma cleaning process, a contamination was applied which represents a real - life contamination actually occurring during electronic manufacturing. The surface contamination and its effect on bondability was tested using a reflow soldering process. The soldering paste on the substrate was melted. The flux component constituted the bond pad contamination. Prior to bonding, the substrates were subjected to plasma cleaning. Then over 100 bonded wire edges were placed on each substrate and tested with the destructive pull test.

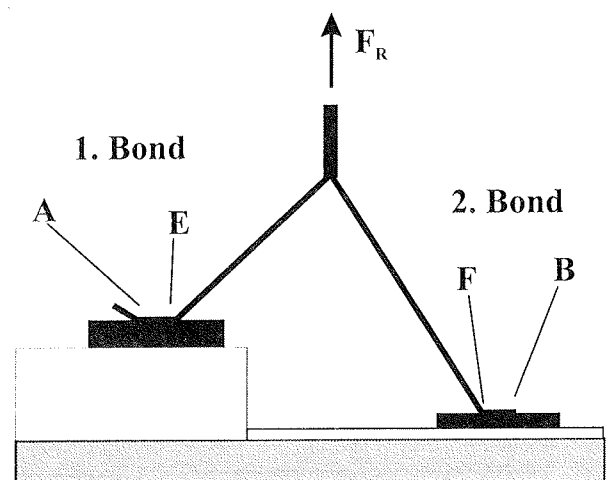


Figure 4: Failure modes in the pull test

Plasma cleaning

Two different plasma processes were used with the samples contaminated with the flux residue of the reflow soldering. The O_2 plasma has an oxidizing effect on the organic deposits; the Purigon (trade name of Linde AG) plasma also has a reducing effect on the metal oxides due to the H_2 component.

Results and discussion

Table 3 shows the results of the individual test series. The average force for all failure modes (bond strength) is given with the standard deviation σ , as well as the distribution by individual failure modes, including the corresponding average force.

Test series a) shows the successful optimization in relation to the initial conditions. Bond detachment is minimized and the average force of 7.2 cN is significantly larger than the suggested value of 4.0 cN. With contaminated surfaces (series b)) the average rupture force

TABLE 3

Test series	F cN	σ cN	Distribution (%)					Remarks
			Average force (cN) for different failure modes					
			A	B	E	F	H	
a) initial state	7.2	0.8	8.0 6.1	1.0 6.1	66.0 7.2	25.0 7.6	0 -	Bond optimization: A, B min.
b) contaminated	5.5	2.9	24.8 4.8	6.0 6.8	35.0 7.5	15.4 7.5	17.1 -	Bonding results significantly inferior
d ¹) O ₂ plasma	6.9	1.8	0.7 7.0	2.2 6.3	81.0 7.3	10.9 7.4	5.1 -	Bonding results almost as good as a). Failure modes A, B drastically reduced
d ²) Purigon plasma	6.2	2.2	19.6 5.7	6.5 5.2	44.2 7.3	21.0 7.1	8.7 -	Improvement but clearly inferior to O ₂ plasma
c) contaminated - with parameter optimization	6.0	2.0	38.5 4.5	0.7 9.2	28.1 7.3	29.6 7.2	3.0 -	No substantial improvement. Effect of contamination cannot be eliminated by parameter optimization
e) O ₂ plasma - with parameter optimization	7.6	0.8	0 -	5.5 6.8	3.7 8.1	90.8 7.7	0 -	Slight improvement compared to d ¹

drops down to 5.5 cN, while the standard deviation increases dramatically to 2.9 cN. Bond detachment increases drastically, and bonding errors are also observed.

This negative effect of the contamination can be eliminated by plasma cleaning in an O₂ plasma. In particular, bond detachment types A and B disappear nearly completely. Purigon plasma is not as effective as O₂ plasma, because the organic deposits only respond to oxidizing action. The main component of Purigon, hydrogen, cannot be active, but it reduces the partial pressure of oxygen,

For test series c) we attempted to compensate for surface contamination by optimizing the bonding parameters. Since bond detachment A cannot be reduced below the 38.5% limits, the procedure was not successful. Thus the effect of contamination cannot be eliminated by optimization only.

In the case of O₂ plasma cleaning, however, the subsequent optimization results in a slight improvement of the bond strength (series e)).

3.2 ENHANCE HYBRID RELIABILITY THROUGH PLASMA CLEANING

Poor wire bonding is the primary cause of failure in hybrid integrated circuits. To create a successful wire bond, strong intermetallic contact between pads on a hybrid and the bond wires must be achieved. This is possible only when the two surfaces are brought into close contact. Once forced together, interatomic forces create a bond. Wire or pad contamination, however,

hinders this process. To remove organic and inorganic contaminants and form strong, low failure bonds, hybrid components should be plasma cleaned prior to wire bonding.

To plasma clean hybrids, plasma of inert gases or a mixture of inert/reactive gases - such as Ar, Ar/O₂, Ar/N₂ - chemically removes molecular layers of contamination. Argon mechanically dislodges contaminants, while Ar/O₂ is a mechanical dislodge and chemical oxidation process.

Contaminants can form on hybrids and ICs during assembly. For example, organic contaminants due to poor rinsing after wet chemical photoresist, strip or etch appear on semiconductor die. Hybrids assembled with an epoxy die attach may suffer from resin bleed. When organic resin runs over the adjacent surface of the ceramic and conductors through capillary action, wire bond strength can be reduced. Another contaminant is outgasses produced during epoxy cure. Although modern epoxies are classified as solventless, they contain low molecular weight diluents, which control epoxy viscosity and rheology. By formulation, diluents bind chemically with the epoxy as it polymerizes. Nonetheless, even with an exhaust system in operation, some diluents can be outgassed during epoxy cure and can build up on the hybrid and impede bonding.

The dicing process for wafer segmentation is another source of contaminants. Water used to cool the dicing diamond saw blade may have impurities, catalyze contaminants from previous process steps, or result in bond pad corrosion. In addition, the aluminum metallization from which most semiconductor bond pads are made

readily oxidizes. If this oxidation layer is too thick, bond pad reliability can suffer.

The hybrid assembly environment also introduces contamination from hand oils used by machine operators, oil fumes and particulates in the air, and more. Containers for hybrid substrates, waffle packs for ICs, and other storage materials can be contamination sources.

Careful handling and processing during hybrid and IC assembly can only minimize contamination; therefore, assembly techniques must incorporate a cleaning step in the process flow.

Removing epoxy resin bleed is a good method to test plasma cleaning effectiveness - if resin bleed can be eliminated, any nonvisible contaminants present also can be removed.

Initially only Ar gas was used to clean the contamination, but long processing times required were unsuitable for a production environment. A 98% Ar / 2% O₂ mixture provided a sufficiently fast process time, although there is always fear that oxygen might discolor the silver filled die attach epoxy. In figure 5a) and 5b) a comparison between AES spectra of an uncleaned and

plasma cleaned bond pad (plasma condition: 98%Ar/2%O₂, 500 W, 15 min, 0.75 torr) demonstrates a sharp reduction in the metallization's carbon peak after plasma clean which also means a reduction in organic contaminant level.

Wire bond test results

Test results shown in table 4 clearly show the efficacy of plasma cleaning. Samples thermosonically bonded on a semiautomatic gold bonder with 6 to 8 g tensile strength and a 3 to 5 percent elongation wire boasted stronger bonds than did hybrids that had not been plasma cleaned. Bond pull strength increased 13 to 25 % with a 13 to 17 % reduction in the standard deviation.

TABLE 4

DESTRUCT PULL TEST SAMPLES	
SAMPLE I	
Before Cleaning	After Plasma Cleaning
X = 5.3 g	X = 6.65 g
S = 1.89 g	S = 1.57 g
Failure Mechanism	Failure Mechanism
8 - Bond lifts 7 - Neck downs	10 - Neck downs 5 - Wire breaks
SAMPLE II	
Before Cleaning	After Plasma Cleaning
X = 6.78 g	X = 6.65 g
S = 1.31 g	S = 1.57 g
Failure Mechanism	Failure Mechanism
11 - Bond lifts 23 - Neck downs 1 - Wire break	31 - Neck downs 5 - Wire breaks
NON-DESTRUCTIVE WIRE BOND PULL TEST	
Product 1	Product 2
Uncleaned	Plasma Cleaned
Total bonds tested - 28.050	Total bonds tested - 18.305
Total bonds failed - 317	Total bonds failed - 12
% Failure 1.13%	% Failure 0.066%
Plasma Cleaned	
Total bonds tested - 11.826	
Total bonds failed - 15	
% Failure 0.13%	

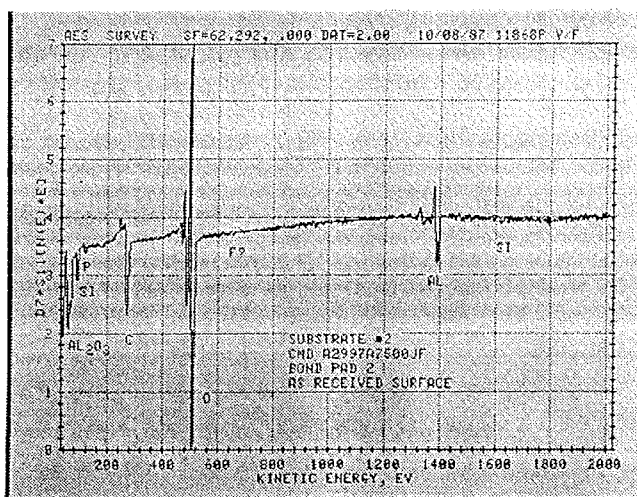
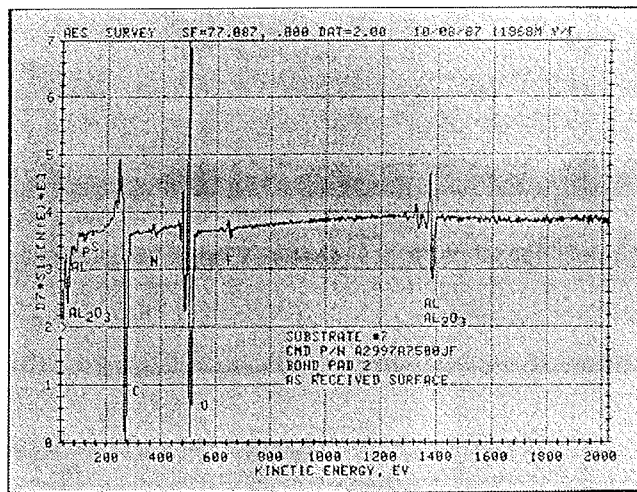


Figure 5: AES - Scanning Auger microanalysis of a bond pad on a component
a) before plasma cleaning
b) after plasma cleaning

A more significant result was a shift in the failure mechanism of the bond when pulled to destruction - failures shifted to neck down and wire breaks versus bond lifts. The cleaner components permitted a reduction in ultrasonic power levels on the bonder and less rework of parts coming off the bonder due to missed bonds.

Conclusion

Plasma cleaning of hybrids and ICs can increase bond pull forces and reduce standard deviations of destructive pull tests, decrease ultrasonic power levels, and wide the effective bond window. In addition, life tests and non-destructive bond pull tests demonstrate an improvement in long - term reliability.

4.0 APPLICATION OF PLASMA TECHNOLOGY IN PCB PRODUCTION

4.1 PLASMA DESMEARING AND ETCHBACK OF MULTILAYER PRINTED CIRCUIT BOARDS

Technics Plasma offers manufacturers of multilayer printed circuit boards a reliable, clean, easy - to - use production tool for removing drill smear from either flex or rigid boards.

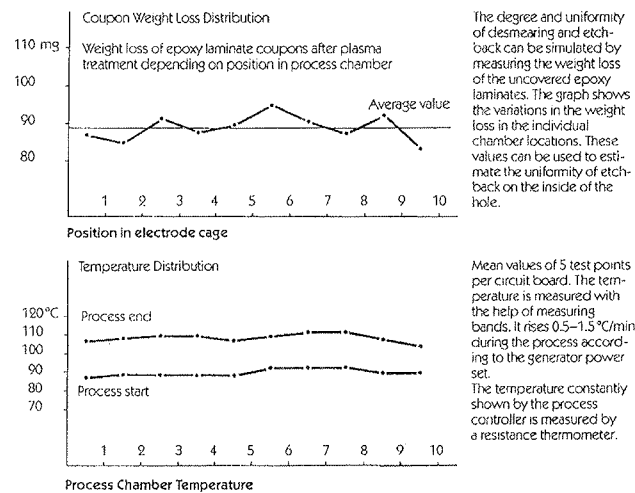


Figure 6: a) etch uniformity versus laminate position in the chamber
b) process temperature versus laminate position in the chamber

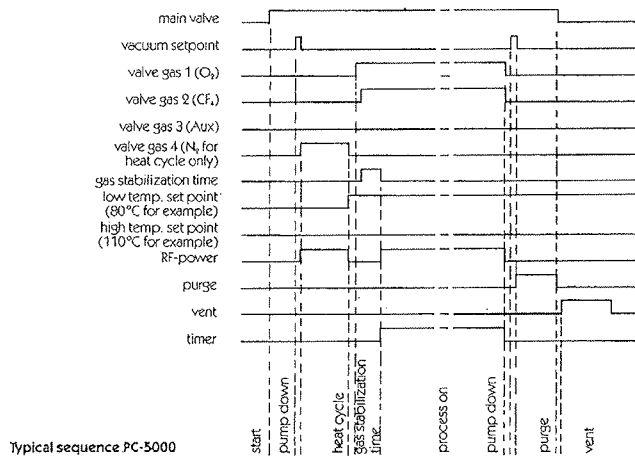


Figure 7: Typical process sequence for drill smear removal

The drill smear found inside drilled holes can be safely removed in an Oxygen - Freon plasma. When desired the system can also be used to perform controlled etch back in multilayer polyimide and epoxy glass boards.

The uniformity across one board, from board to board and batch to batch is unsurpassed due to patented Planartube electrodes which are driven by low frequency RF generators.

Typical performance results are shown in figure 6 where etch rate and laminate temperature uniformity are displayed. As well, in figure 7 typical process sequence is displayed.

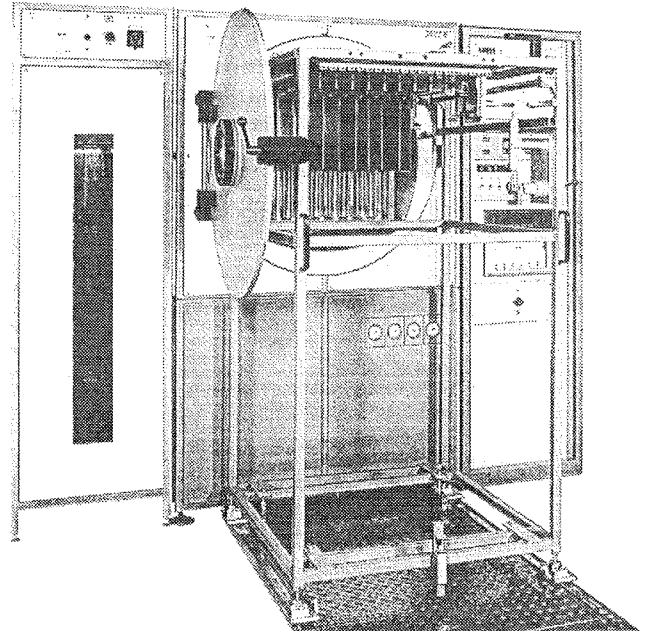
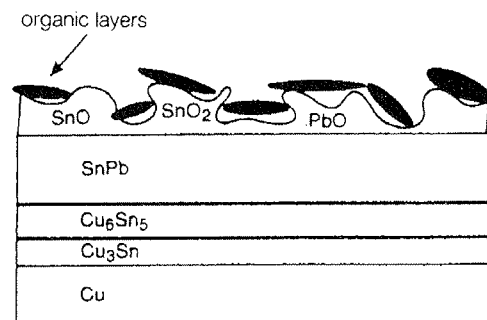


Figure 8: Technics Plasma desmear system

4.2 FLUXFREE SOLDERING WITH PLASMA PRETREATMENT

Introduction

During the wave soldering process the active and passive components are connected with the circuit carrier of the PCB by a collective soldering procedure and thus made an operative flat pack group. The jointing partners are in general supplied in an unsolderable status, covering layers impede the wetting procedures in the solder melting, figure 9.



covering layers impair the soldering

Figure 9: Covering layers impair the soldering

These layers are organic, they cover as part of industry atmospheres all surfaces and have the even more impeding effect the longer the molecule chains of the hydrocarbons are.

Further layers are metal oxides originated by reactions with oxygen. Before the solder process can be started a preparation is necessary to ensure the jointing ability. Usually flux is used. Therefore everybody associates wave soldering with flux. A procedure without flux, however, shows differently. The active ingredient in modern, low solid content flux is an organic acid. Heat supply effects the transformation from metal oxide to metal complexes respectively to metal. Due to the unknown supply status of components and PCBs (quality and thickness of the covering layers are usually not known) one has to work with a surplus of flux so that the chemical process may be incomplete and not wanted residues remain on the flat pack groups. These residues may effect the long term reliability by decreasing the surface resistance respectively by migration. In principle these processes apply to all flux variations no matter whether they are conventional colophony formations, low solid content types or formic acid in protective atmosphere solder systems.

Principle of fluxfree soldering

SnO, SnO₂, PbO form a porous monolith with a very high melting point (1000°C). The surface failure spots are bare after the plasma treatment, since oxygen plasma ashes away all organic contaminants as well as activates the surface increasing its wettability. Now, an appropriate vaporized process material (purified water) is applied to the surface. Condensate precipitates in the fine openings of the oxide layer. When the SnPb layer prepared this way contacts the solder wave the temperature rises fast (500 K/s) and leads to the quick volume expansion of the precipitated condensate amounts. The volume increase (1000 : 1) lifts the oxide layers, fragments are washed away by the moving solder wave and the solder connection is formed by the copper - tin diffusion at the oxide free areas, figure 10.

Solder connections generated by such a new method have of course to undergo a line of tests in order to prove their quality and long term reliability. All visual, structural, electrical, physical and burn in tests turned out to be successful.

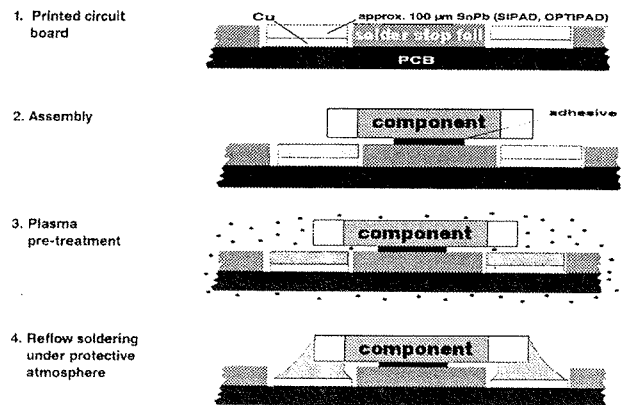
There are no restriction in the range of components that can be processed. All available component shapes are suitable for the plasma method.

System Concept

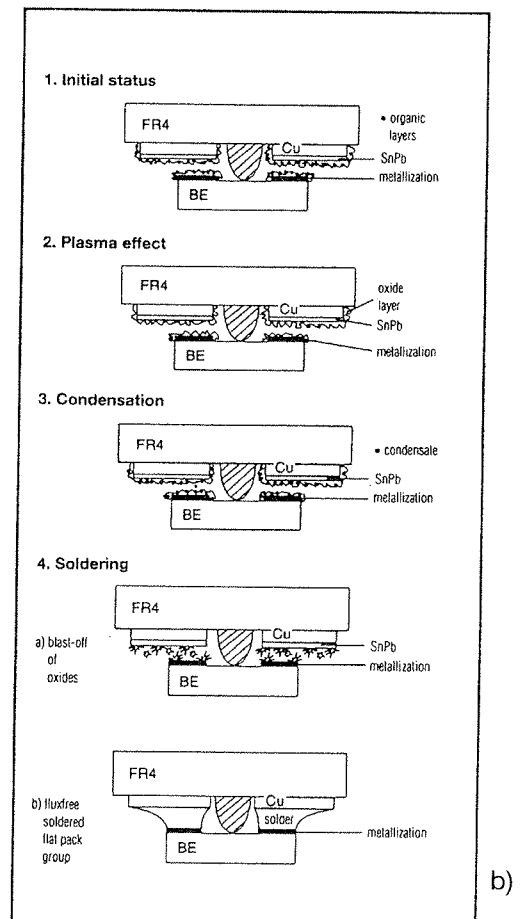
A piling device collects pallets (5 off per batch) from the feeder and passes them on to the receptacle drawer of the plasma chamber, figure 11. The chamber closes and evacuates. After completion of the plasma treatment the pallets are extended, separated again, and by means of band conveyor they run into the preheating, used only for tempering. Then the condensation process is effected and the conveyance to the dual wave.

The solder process is executed under the protective atmosphere whereas the concentration of the remaining oxygen may be higher than in the conventional protective atmosphere systems. The gas consumption runs at 14 - 15 m³/h. The flat pack groups leave the system completely clean and free of any residues.

Perspective: Fluxfree reflow soldering under plasma



a)



b)

Figure 10: a) Principle of fluxfree soldering
b) Detailed mechanism behind fluxfree soldering

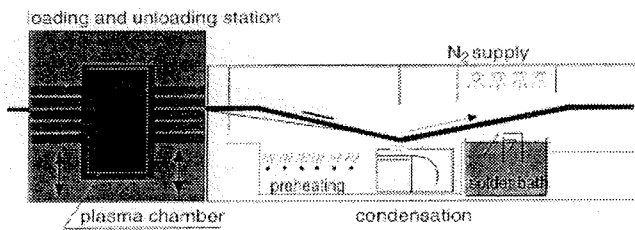


Figure 11: Fluxfree soldering system concept

- /2/ R.Buck, ENHANCE HYBRID RELIABILITY THROUGH PLASMA CLEANING, Hybrid Circuit Technology, December 1988
- /3/ H.Schmid, Super Fine Cleaning with Liquid Phase Pre-cleaning and Subsequent Plasma Treatment, PC, October 1995
- /4/ Technics Plasma GmbH, Application Reports

For more information about Technics Plasma systems and their applications, please call:

5.0 LITERATURE

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MIKROIKS d.o.o., Mr. Iztok Šorli
 Dunajska 5, 1000 Ljubljana, Slovenia
 tel. +386 (0)61 312 898
 fax. +386 (0)61 319 170

PREDSTAVLJAMO PODJETJE Z NASLOVNICE REPRESENT OF COMPANY FROM FRONT PAGE

ISKRA Kondenzatorji Industrija kondenzatorjev in opreme d.d.

Iskra Kondenzatorji d.d. praznuje v letošnjem letu 45 let delovanja. Skromni začetki proizvodnje navitih kondenzatorjev na sedanji lokaciji v letu 1951 so bili nadaljevanje razvojnega dela na inštitutu IEV v Ljubljani, ki je bil ustanovljen z namenom, da razvija elektronske komponente za nastajajočo slovensko elektronsko industrijo.

V začetku je bila proizvodnja prilagojena možnostim in zahtevam domače industrije. Kmalu se je pojavila zahteva za širjenje programa proizvodov za nove aplikacije. Že po 10-tih letih delovanja je proizvodnja obvladovala širok program kondenzatorjev za različne namene uporabe, tako v elektroniki, kakor tudi na področju elektroenergetike. Proizvodnja je bila delno velikoserijska in pa maloserijska in prilagojena posameznim kupcem.

V 70-tih letih se je tovarna začela intenzivno usmerjati v prodajo preko meja domovine. Izvoz je postal izziv, še bolj pa potreba za nadaljnji razvoj. Prodaja, predvsem v industrijsko visoko razvite države, je zahtevala absolutno izpolnjevanje zahtev kakovosti in solidnega poslovanja. Raziskave in aplikativni razvoj je bilo potrebno usmeriti v produkte, ki so obetali ekonomično proizvodnjo in konkurenčnost na trgu. Razvoj je sledil trendom v svetu s široko paleto proizvodov za uporabo na področju elektronskih naprav, naprav elektroenergetike in odprave radiofrekvenčnih motenj. Večina proizvodov mora ustrezati mednarodnim in celi vrsti nacionalnim predpisom in standardom tako v Evropi kakor v ZDA in

Kanadi. Ustreznost tem predpisom in standardom mora biti potrjena z atesti, ki so obvezni za plasma proizvodov na tehnično in komercialno izredno zahtevnem tržišču. Zahteve na področju razvoja, proizvodnje, trženja in na področju ostalih segmentov poslovanja so privedle do spoznanj, da je možno zagotavljati zahtevano kakovost le s certificiranim sistemom ISO 9001, kar je bilo tudi realizirano v letu 1995.

Danes firma Iskra Kondenzatorji samostojno obvladuje vse poslovne aktivnosti. Preko 90% proizvodov prodaja na tujih trgih. Kupci in uporabniki proizvodov Iskre Kondenzatorji so svetovno znani proizvajalci elektronskih naprav, računalnikov, bele tehnike, električnih orodij, elektroenergetskih sistemov, električnih strojev itd. Tovarna predstavlja pomembnega proizvajalca kondenzatorjev v svetovnem merilu, tako po količini, kakor po kakovosti.

Za uveljavitev v svetovnem merilu je bilo potrebno veliko strokovnega dela, ki je vseskozi potekalo v sklopu tovarne ob sodelovanju z domačimi strokovnjaki in znanstveno-raziskovalnimi institucijami. V razvoj proizvodov, ki obsega ob bazičnem predvsem aplikativni razvoj, je bilo vloženo ogromno interdisciplinarnega znanja iz vseh področij naravoslovnih ved, še posebej, ker firma ob osnovnem programu obvladuje tehnologijo proizvodnje praktično vseh sestavnih delov.