Methods and Technologies for Crafting of Printed Circuit Boards which Works in Space

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Each artificial satellite have a lot of electronics. The term "electronics", is determinate such as the set of components placed on the plate [1]. This plate is called a printed circuit board. Printed circuit boards for electronics space are more precise execution and special manufacturing techniques. Example of a printed circuit board for the spacecraft is shown in Figure 1.

Figure 1 - Example of a printed circuit board for the spacecraft

For higher power density of power electronics converters, the integration of passive into the printed circuit board (PCB) is a low cost and integral manufacturing approach. The configuration and manufacturing processes of the passive substrate are described. As an example, a 3.3V/20A output non-isolated synchronous buck DC-DC converter with 500 kHz switching frequency is designed and manufactured using the passive substrate that functions as the inductor. The electrical design and power loss analysis of the passive substrate are illustrated. The thin converter, better thermal performance and high power density can be achieved.

For high frequency modules via hole metallization method is used. The vias are drilled in polyimide/copper (PI/Cu) flexible printed circuit boards (PCBs) using KrF excimer pulses, and then pre-metallized using a scanned Ar^+ laser. In the premetallization step, a thin (20–50 nm) and narrow (2–10 μm) palladium layer is deposited on the polyimide-covered side of the PCB and on the wall of the vias using the laser-induced chemical liquid-phase deposition method. After the pretreatment, the Pd covered holes are immersed into a Cu electroless plating bath. Plated copper vertical and horizontal interconnects are analyzed by optical microscopy, focused ion beam, profilometry and resistivity measurements. The results show that the copper deposits formed on the pre-metallized surface of PCBs have high chemical purity, excellent adhesion and almost bulk conductivity, but, so far, due to unclear reasons, high through hole resistance Figure 2. Preliminary results were presented regarding the laser-assisted drilling and metallization of via holes in flexible, 75 μm thick (20 μm Cu, 55 μm PI) PCB sheets. Vias with diameters of 20–60 μm at the entrance of a 15° tilting of wall were generated using an ablation procedure in vacuum with subpicosecond excimer laser pulses. An Ar+ laser-induced chemical liquid-phase deposition of a thin palladium film was executed to obtain locally-sensitive areas on the PCB (via holes and links) for further electroless copper plating. A several minute-long electroless copper bath on the sensitized PCB resulted in 0.2–0.5 μm thick copper plating on the pre-metallized areas of the PCB including both via walls as well as the surface interconects. The measured resistance values of the vias were higher than expected. Further experiments are still needed to make the physical parameters of the vias better (reduction of size, resistance and losses).

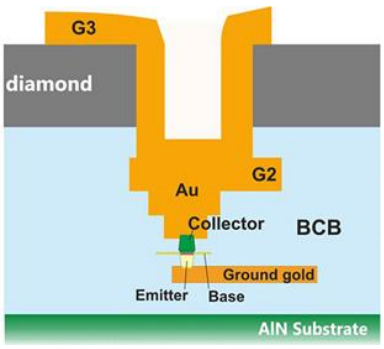

Figure 2 - Hole metallization method

Pd deposition process, the focused laser beam acts as the micro-reactor at the interface between the solution and polymer surface. The character of the chemical reaction that yields a metallic palladium film deposit on the polyimide from the palladiumamine/formaldehyde system is not precisely known. In the control experiments, where the temperature of the palladium-amine/formaldehyde solution was raised over 60°C, a black colloidal precipitation (Pd and PdO) was observed in the liquid media but not on the surface of the polymer or the test-tube. In the case of the laser-assisted process, a gray, mirror-like, metallic thin film of palladium was formed on the substrate, so the reaction appears to be photolytic. The incident beam is not orthogonal to the surface (the angle of incidence is approximately 15° as seen in Fig. 4), when it passes through the cone-like via, and the deposition of the Pd is attained as well in the case of normal incidence to the surface. The formation of deposits is uniform over the entire surface inside of the via hole (Figure 3).

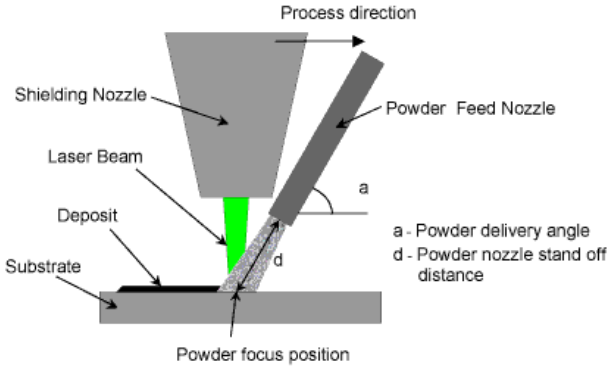

Figure 3 - Pd deposition process

ESSENTIAL parameters needed for the efficient design of integrated microwave circuits are dielectric properties, the degree of passive intermodulation, and the microwave copper resistance of the printed-circuit-board (PCB) substrate on which the active elements are mounted. As components are increasingly miniaturized and frequencies increased, the need for accurate dielectric measurements of low-loss substrate materials increases. The properties of these materials should be known over a wide temperature range.

Polychlorinated biphenyls (PCB's) , similar in structure and effects to certain chlorinated hydrocarbon pesticides have been found in ecosystems of Britain, northern Europe, and in several sections of the United States. PCB's employed as plasticizers, dielectrics, and heat transfer fluids have grown in use since the forties in a manner somewhat paralleling DDT. Additionally PCB's have been shown to be powerful inducers of hepatic enzymes as well as inhibitors of the carbonic anhydrase system essential to calcium deposition in egg shell production. These factors alone emphasize urgency in the further investigation of PCB distribution in the global environment,

primary sources of release and effects on basic food systems of which marine diatoms play an important part. Because previous work had shown Cylindrotheca closterium to be capable of absorbing, concentrating, and metabolizing DDT, similar work was undertaken with the organism and PCB. Figure [4].

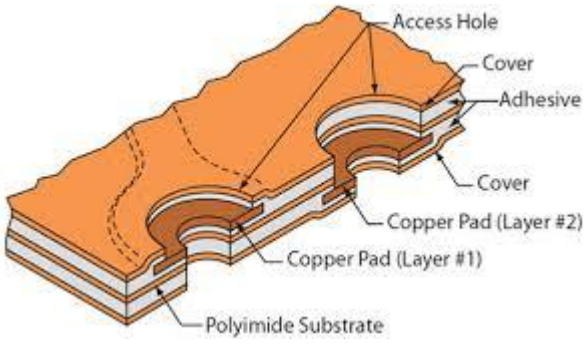

Figure 4 - Polychlorinated biphenyls (PCB's)

Thus, the critical aspects and characteristics to be kept in mind while designing and manufacturing PCBs destined for use in space products were discussed. It is shown that used systems are of national importance, and that they also have the potential to cause destruction to human life or property.

References:

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Quality in the Space Instrument

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The improvement of the efficiency of Space engineering in Russia is one of the challenging tasks. Nowadays people work on various significant projects (such as “Audit of Projects”, “Products and Marketing”, “Business systems”, “Technology”, “Automation” and “Quality”) aimed at the improvement of the quality of space instrument-making. Space instrument-making is a large-scale project for the integration of intellectual and industrial resources. It is implemented on the basis of “Russian Space Systems” (RSS) [1].

Today any company involved in instrument-making has not only a comprehensive range of basic technology and equipment, but also the traditions of high quality instrument-making for space