



Plasma Ruggedized Solutions

Global Provider of Custom Ruggedized Engineering Solutions



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Plasma Applications and its Importance

Focus

The focus of this paper is to provide an understanding of Plasma application as it relates to surface treatment, preparation and cleaning. **Plasma treatment is essential for a proper coating/encapsulation result.**

A Brief Description

Scientifically designed Plasma processes and applications to target surfaces provide an invaluable aid in bonding coatings and relevant environmentally protective agents to printed circuit boards, components and various other electrical and mechanical devices.

Plasma is often referred to as the 4th state of matter, the other three being solid, liquid and gas. A plasma cloud or entity is a distinct state of matter containing a number of excited particles. In an ordinary gas, each atom contains an equal number of positive and negative charges; the positive charges in the nucleus are surrounded by an equal number of negatively charged electrons, and each atom is electrically “neutral”.

A gas becomes plasma when the introduction of heat or other energy causes a significant number of atoms to release some or all of their electrons. The remaining parts of those atoms are left with a positive charge, and the detached negative electrons are free to move about. Those atoms and the electrically charged gas are said to be “ionized”. When enough atoms are ionized to significantly affect the electrical characteristics of the gas it becomes Plasma.

In many cases interactions between the charged particles and the neutral particles are important in determining the behavior and usefulness of the plasma entity. The type of atoms in a plasma, the ratio of ionized to neutral particles and the particle energies all result in a broad spectrum of plasma types, characteristics and behaviors. These unique behaviors cause plasma to be useful in a large and growing numbers of applications important to industry and really the world around us.

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At Plasma Ruggedized Solutions one of our main objectives is to provide our customers with technically sophisticated material applications that provide optimal protection against whatever environmental threat is specified. To affect a proper technical solution the coating or protective materials chosen must first bond tightly to the target surface. If there are foreign particulates or materials present the coating is unlikely to bond properly and thus prevent the requisite protection desired. **The importance of a clean target surface prior to the coating or encapsulation process cannot be over emphasized**



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There are two main types of Plasma treatments employed by PRS; Desmear (Etchback) and Surface Treatment (Modification). Plasma treating a printed circuit board subsequent to board fabrication and prior to board “stuffing” cleans the surface of the board (called the “desmear process”) clearing it of various and extraneous materials and debris resulting from the board fabrication process. The Desmear process actively clears these materials from the PCB it’s various passageways, holes and unique topography. As the Desmear process is performed under vacuum conditions (approximately 300 millitorr) with a select alchemy of ionized gases the byproduct and debris are safely disposed of with little or no emissions (plasma treatments are far superior to the variety of “wet” chemistry cleaning processes). Various plasma profiles (i.e. gas mixtures and attendant pressures) are created by PRS depending on the PCB or mechanical component’s condition or materials. The frequency at which PRS plasma generation functions is 40 kHz rather than the conventional 13.5 MHz. This is to insure the safety of the PCB’s and to better control the Plasma process. Further taking advantage of plasma’s inherently balanced ion nature through proprietary process development, software and hardware configuration, an effective, controlled ESD-safe environment is provided (having processed millions of printed circuit board assemblies).

With regard to the surface treatment process, the PCB’s are typically at a stage where they have been “stuffed” and soldered but are prior to the coating or encapsulation process. Depending on the solder mask used by the customer and the level of cleanliness desired, a unique Plasma profile may be created that will clean and “roughen” the surface of the solder mask at the molecular level. In certain cases and with an optimal Plasma profile chemical emissions will emanate from the substrate allowing the coating process to be particularly effective in its attachment and bonding.

One unique example of this is Plasma treatment to a Teflon substrate. Many customers in the A&D industry now prefer Teflon given its unique attributes. However this choice may present challenges to coating adhesion as Teflon is a difficult surface to “coat” because of its physical and chemical properties. Application of a custom/specialized PRS Plasma profile causes emission of Fluorine atoms and other materials from the Teflon substrate. In this Plasma treated condition the PCB is now particularly receptive to the coating process exhibiting exceptional adhesive bonding results post coating application.

In this whitepaper we touched on the virtues of Plasma, its applications and some targeted uses. While most of the commentary above addressed applications relating to printed circuit boards and electronic componentry, Plasma applications are quite useful with mechanical products and in certain cases may be used as a specialized process to extract coatings or materials from a desired target. For a more definitive and specific explanation of Plasma and its unique offerings please contact the engineering department at Plasma Ruggedized Solutions.

The PRS technical team stands ready to support our customer’s unique and environmentally challenging needs. Please contact us directly at www.plasmarugged.com.