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Non-thermal Plasma Surface Preparation of Metals

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Figures

Foreword

This AMPP standard covers the use of a non-thermal atmospheric plasma cleaning (APC) process to achieve one of five defined degrees of surface cleanliness of coated or uncoated metallic substrates prior to the application of a protective coating or lining. The degrees of cleanliness within this standard are defined as APC-1 “Clean to Bare Substrate,” APC-2 “Very Thorough Cleaning,” APC-3 “Thorough Cleaning,” APC-4 “Moderate Cleaning,” and APC-5 “Light Cleaning.”

APC is a process that uses compressed air and electricity to form a non-thermal beam of atmospheric-pressure air plasma which is directed at a surface by automated or manual means to chemically react with and remove coatings, loosely adhered rust and other corrosion products, and contaminants (including hazardous materials) from a substrate to achieve a defined degree of surface cleanliness. Plasma is a state of matter similar to gas that can be achieved by adding energy to a gas system, resulting in charged species such as ions and electrons as well as chemically reactive metastable molecular and atomic species. Non-thermal plasma refers to a sub-type of plasma that is sometimes referred to as “cold plasma” since the temperature of the plasma is significantly lower than traditional thermal plasma processes, such as plasma cutting, plasma arc welding, and thermal plasma spray material deposition. Thermal plasmas and their processes are, by design, hot enough to melt and vaporize nearly all metals and other materials. Non-thermal plasmas function in an operating regime in which plasma temperatures are specifically limited to prevent melting and damage to the underlying metal substrates. Throughout this document, the terms “atmospheric plasma” and “non-thermal plasma” are used interchangeably and shall be considered to both be in reference to non-thermal atmospheric plasma.

This standard describes the use of atmospheric plasma technology for surface preparation and cleaning of various metallic substrates as required for proper application of coatings or linings, welding, adhesive bonding, and other applications in which atmospheric plasma will provide the necessary surface condition.

APC does not create a new primary anchor pattern on the metallic substrate, known as “surface profile.” The coatings industry uses APC primarily for recoating or relining projects in which there is an adequate pre-existing surface profile under the coating being removed. The degrees of surface cleanliness cited within this standard to be achieved by APC methods are not intended to require that a surface profile be present or defined prior to coating application. It is worth noting that surface profiling is achieved when APC is used on concrete substrates.

APC completely removes organic contaminants from the substrate surface, including previously applied organic protective coatings and any carbon-based contaminants (oil, wax, grease). APC also reduces and may completely remove loosely adhered rust and other corrosion products. This method is used both when it is a more feasible means of surface preparation than, for example, abrasive blast cleaning, power or hand tool cleaning, or chemical stripping, and as a secondary surface preparation procedure to cover areas that are inaccessible during the primary preparation of the bulk surface. APC may be used when the application of high-performance coatings requires extensive surface preparation, surface decontamination, increased adhesion of the bonding interface, or a combination of the three.

This standard is intended for use by coating or lining specifiers, applicators, inspectors, or others who have responsibility to declare a standard degree of surface cleanliness to be achieved by APC methods.

Scope

This standard contains the general requirements for the safe and effective use of APC equipment, operated either manually hand-held or through use of automation, to prepare various metallic surfaces for maintenance, repair, recoating, or lining. This standard does not address surface preparation of concrete.