



Review Paper

An Overview of the Application of Plasma Technology in the Protection of Cultural and Historical Objects



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Abstract

Nowadays, over time and increasing the awareness of the destructive effects of the use of chemical and toxic substances on the objects, the environment and users, the replacement or, minimum use of these harmful materials in the treatment and protection of valuable and rare objects is a priority. So throughout the world, researchers are seeking to develop and use safe and standard methods in this area. One of these methods is the plasma technology. Plasma can be defined as the fourth state of matter. Giving energy to a gas will induce the ionization of some of its molecules and atoms. The plasma contains therefore, besides neutral molecules, positively and negatively charged particles, although its overall charge is neutral. Cold plasma due to features such as low temperature and high energy, in addition to a wide range of applications in various fields, since 1979, has attracted the attention of specialists in conservation and restoration of cultural and historical objects. Cold plasma in disinfection and cleaning treatments of works has been examined as a non-toxic and non-invasive alternative in the field of cultural heritage. Different methodologies were developed in time using mechanical methods, solvents and, more recently, laser, to cleaning of architectural surfaces, and in a more recent time, atmospheric plasma began to be tested for such application. A positive feature of plasma is the fact that is contactless: it does not interfere mechanically with the surface being treated, and also with soft chemical action, the process of cleaning only limited to the first layers of the surface. Hence this method can prevent the adverse effects of solvent and /or imprisonment and lateral harmful products on the pores and porous surface, which is often present in common cleaning methods. In other words this method could be a good alternative for abrasion methods, that cannot remove the dirt from the pores and often lead to the damaging of the original surface, or for chemical methods, which solvents can transport undesired materials (dirt or old coatings) deeper inside through pores, cavities or cracks. Plasma might substitute or be used in combination with other techniques, particularly for delicate objects where original material might be endangered by a mechanical or wet cleaning method. In many cases the plasma alone is not as efficient as traditional methods. For instance, in case of removal of graffiti, a combination of plasma with traditional cleaning methods showed surprisingly good results or in the case of removal of oil paint from wall paintings, a pre-treatment with plasma can improve the removal with traditional solvents. The application of innovative cleaning technology on cultural properties demands sufficient knowledge concerning the cleaning process itself and the long-term behavior of an object after cleaning, because they are often unique and irreplaceable. Furthermore, the experiences carried out in various museums and research centers mentioned in this paper showed that cold plasma is appropriate methods to remove corrosion

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curst on metals particularly tarnished silver. Decontamination of wood and the objects based on cellulose like paper and cotton as well as protein materials (leather, wool) is another application of cold plasma presented in the paper.

Keywords: Plasma technology, Cultural Heritage, Cleaning, Disinfection, Non-destructive.

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