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Editorial

Recent Advances in Atmospheric-Pressure Plasma Technology

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1. Introduction

In recent years, plasma technology has presented an alternative in the processing and development of new materials. Of the plasma processing methods developed thus far, atmospheric pressure plasma is the most economically accessible, due to the low costs of this technology. Among the first applications of plasmas in atmospheric pressure was the treatment of various polymeric materials. Plasma treatment efficiently improves the surface wettability and adhesion properties of different types of materials. This is possible because plasma parameters such as particle density, collision frequency, mean kinetic energy of the particles, and the presence of chemical active species will cause a large variety of elementary processes both within the plasma volume and on the plasma–material interface. Consequently, the quality and magnitude of the polymer surface treatment, including etching, functionalization, and crosslinking, might also be controlled [1]. Generally, the plasma used in material processing can be generated in different gases, pressure ranges, or discharge geometries.

Another technique developed later was that of a plasma polymerization technique. Plasma polymerization is a versatile method for the deposition of films with functional properties, which are suitable for a range of applications. These plasma polymers have different properties than those fabricated via conventional polymerization: the plasma-polymerized films are usually branched, highly cross-linked, insoluble, and adhere well to most substrates [2].

In the last decade, new applications of plasmas at atmospheric pressure have been developed, such as: plasma medicine, plasma agriculture, plasma used in food industry, in 3D printing technology, textile industry, and so on. This Special Issue attempts cover all these applications, publishing both target applications of the atmospheric pressure plasma and also the fundamental aspects that appear in the case of these types of discharge.

2. Review of Special Issue Contents

Contributions to this Special Issue focus on different aspects of Atmospheric-Pressure Plasma Technology, giving valuable examples of applied research in the field. This Special Issue of *Applied Sciences*, "Recent Advances in Atmospheric-Pressure Plasma Technology", includes one review [3] and eight original papers [4–11], providing new insights into the application of atmospheric pressure plasma technology.

Domonkos et al [3] discussed the application of cold atmospheric pressure plasma (CAPP) technology in different configurations. Their manuscript outlines the application of CAPP in medicine for the inactivation of various pathogens (e.g., bacteria, fungi, viruses, sterilization of medical equipment, and implants) in the food industry (e.g., food and packing material decontamination), agriculture (e.g., disinfection of seeds, fertilizer, water, soil). In medicine, plasma also holds great promise with regard to direct therapeutic treatments in dentistry (tooth bleaching), dermatology (atopic eczema, wound healing), and oncology (melanoma, glioblastoma).

Asghar et al. [4] discussed the changes induced in the atmospheric pressure plasma jets (APPJs) characteristics of the gas mixture; more precisely, argon/oxygen (Ar/O_2) mixture.

The voltage–current waveform signals of APPJ discharge, gas flow rate, photo-imaging of the plasma jet length and width, discharge plasma power, axial temperature distribution, optical emission spectra, and irradiance were investigated.

Chodkowski et al. [5] focused on fabrication and physicochemical properties investigations of silica-multiwalled carbon nanotubes/poly(dimethylsiloxane) composite coatings deposited on the glass supports activated by cold plasma in air or argon. They found that the type of plasma influences the surface properties of the deposited coating.

AlShunaifi et al. [6] realized a two-dimensional numerical model to simulate operation conditions in the non-transferred plasma torch, used to synthesis nanosilica powder. The numerical results showed good correlation and good trends with the experimental measurement. This study allowed us to obtain more efficient control of the process conditions and better optimization of this process in terms of the production rate and primary particle size.

Suenaga et al. [7] realized an evaluation of the effect of plasma gas species and temperature concerning the reactive species produced and the bactericidal effect of plasma. Nitrogen, carbon dioxide, oxygen, and argon were used as the gas species, and the gas temperature of each plasma varied from 30 to 90 ◦C. The results demonstrate that the plasma gas type and temperature have a significant influence on the reactive species produced, and the bactericidal effect of plasma and the disinfection process could be improved by properly selecting the plasma gas species and temperature.

Suenaga et al. [8] design and build a multi-gas temperature-controllable plasma jet that can adjust the gas temperature of plasmas with various gas species and evaluated its temperature control performance. By varying the plasma jet body temperature from −30 °C to 90 °C, the gas temperature was successfully controlled linearly in the range of 29–85 °C for all plasma gas species.

Papadimas et al. [9] realized a single dielectric barrier discharge (SDBD)-based actuator. The consumed electric power was measured, and the optical emission spectrum was recorded in the ultraviolet–near infrared (UV–NIR) range. The average temperature of the neutral species over the actuator was found to be around 410 K at the maximum power level.

Khan et al. [10] reported a dielectric barrier discharge (DBD) plasma rotational reactor for the direct treatment of wheat flour. The primary research goal was to determine the effects of short-period cold plasma treatment of DBD type on flour and dough properties. The obtained results showed a 6–7% increase in flour hydration due to cold plasma treatment, which also contributes to hydrogen bonding due to changes in the bonded and free water phase.

Rueda et al. [11] report a study which is focused on gas treatments (NOx abatement) by dielectric barrier discharge (DBD) at atmospheric pressure. Two diagnostic methods are considered to evaluate the discharging ratio on the reactor surface: an image processing method and a DBD equivalent circuit analysis, both presented in this paper. The experimental results show good agreement between the two methods. These two strategies work very well and provide remarkably coherent results under different intensity conditions.

This Special Issue has attracted 38 citations and received more than 8700 views, demonstrating the growing interest in this topic.

The Editor would like to express his appreciation to the contributors for their dedication and excitement during the process of compiling their individual essays for this Special Issue. The Multidisciplinary Digital Publishing Institute (MDPI) editorial team members also deserve praise for their professionalism and commitment to publishing this Special Issue. We hope that the readers will enjoy this collection of papers and will be motivated to envision fresh concepts for future developments in plasma research technology.

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