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Guest Editorial

The Third Special Issue on Atmospheric Pressure Plasma Jets and Their Applications

SINCE the first and second IEEE Special Issues dedicated to the “Atmospheric Pressure Plasma Jets (APPJs) and Their Applications” were published in November 2012 and March 2015, respectively, studies on APPJs have become a hot topic. Fig. 1 shows the publications on the APPJ in the last two decades from Web of Science. It clearly shows that this topic has significantly grown in the past decades.

APPJs generate plasma plume in open space rather than in a confined gap between two electrodes, which opens the opportunity for various applications such as plasma medicine. For APPJs, the working gases of most of current APPJs are noble gases or mixtures of the noble gases with a small amount of O₂ or air. If the ambient air is used as the working gas, several serious difficulties are encountered in the plasma generation process. Among these are high gas temperatures and disrupting instabilities. Equally important, for plasma medicine, it has strict requirements for the safety of plasma devices. It is preferable that the device can be handheld and the plasma can be directly touched by a human without any harm. Currently, there are only very limited APPJs using air as the working gas. Therefore, in the future, studies on APPJs using air as the working gas are urgently needed.

Besides, one of the most important applications of APPJs is plasma medicine. For applications of plasma medicine, a better understanding of what specific plasma reactive agents (RAs) (e.g., which reactive oxygen–nitrogen species, electric fields, pH changes, and so on) induce specific physiological responses such as their intervention in cellular signaling is urgently needed. It is then critical to understand how to deliver these RAs more efficiently and safely, and then develop the most effective and safe plasma devices and treatment protocols. Although various possibilities for plasma-assisted control (e.g., differentiation) of stem cells have been demonstrated, the ability for the controlled cell reprogramming directly during the wound healing process is yet to be discovered. These and several other lines of scientific enquiry at the edge of plasma, materials, and biological and medical sciences, including numerical simulations, are expected to be the subject of interdisciplinary research efforts in the future.

This Special Issue reflects the latest progress in APPJs and Their Applications. A total of 13 articles in this Special Issue cover the topic of generation, diagnostics, modeling, and various applications, especially wound healing of APPJs. The diversity of the research in this area can easily be seen in this

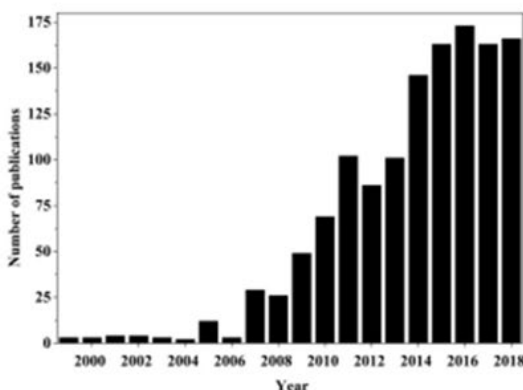


Fig. 1. Publications of “APPJ” from web of science.

Special Issue, and we are glad to share with you the happiness of reading many authors’ stories of successes.

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