Publ. Astron. Obs. Belgrade No. 103 (2024), 135 *Poster*
https://doi.org/10.69646/aob103p135

INVESTIGATING THE THERMAL PROFILE OF AN ATMOSPHERIC PRESSURE ARGON PLASMA JET ON A CONDUCTIVE AND INSULATING MESH SURFACE

JAMES LALOR[1] and VLADIMIR MILOSAVLJEVIĆ[1,2]

[1]*School of Physics, Clinical and Optometric Sciences, Technical University of Dublin, Dublin, Ireland*
E-mail james.lalor@tudublin.ie

[2]*Faculty of Physics, University of Belgrade, Serbia*
E-mail vladimir@ff.bg.ac.rs

Abstract. Atmospheric pressure nonthermal plasmas hold great promise for applications in environmental control, energy conversion, and material processing. This study examines the interaction between an Argon atmospheric pressure plasma jet (APPJ) and both insulating and conducting mesh surfaces. The dielectric barrier discharge APPJ operated at a voltage range of 8 kV and a frequency of 21 kHz. Multiple studies have investigated the interaction between an atmospheric pressure plasma jet directed perpendicularly onto both dielectric and conductive flat surfaces. These studies reported that the jet exhibits a laminar flow which spreads radially from the point of impact. The highest temperature is observed at the central impact zone, with a radial temperature gradient decreasing outward due to the jet expanding along the planar surface and the associated heat dissipation. This study employs a novel technique by treating a mesh substrate with 0.8 mm x 0.8 mm openings so the gas plume can partially pass through the surface. This allows for mapping the thermal interaction between the APPJ and the substrate, enabling a thermal crosssection of the jet plume to be studied. A series of experiments were performed to investigate how different materials, such as metals and polymers, respond to thermal energy from the APPJ in terms of temperature rise, heat distribution, and cooling rates. The distance between the APPJ nozzle outlet and the mesh surface (standoff distance) was varied between 0 to 70 mm, and the corresponding thermal profile was recorded to determine an optimal standoff distance for the APPJ to prevent surface damage due to overheating. A second variable, treatment duration, was also examined. By fixing the standoff distance and varying the treatment duration from 0 to 240 seconds, the thermal data for various contact times were studied. For this research, an FLIR i7 thermal camera with a thermal resolution of 140 x 140 pixels was used.

The research demonstrated that closer standoff distances increased the energy deposition with the material properties significantly influencing temperature dynamics.