Proceedings of the 11th International Conference on Fluid Flow, Heat and Mass Transfer (FFHMT 2024)
Chestnut Conference Centre - University of Toronto, Toronto, Canada – June 16-18, 2024
DOI: 10.11159/ffhmt24.005

A Conical Radio-Frequency Inductively Coupled Plasma (RF-ICP) Source with applications in Materials Processing and Elemental Analysis

Prof. Javad Mostaghimi
University of Toronto, Canada

Radio-frequency inductively plasma (RF-ICP) torches have established themselves as a powerful tool in materials processing, e.g., nano-powder synthesis, and in trace element analysis, e.g., ICP-MS

In 1961, Reed presented the first continuous operating RF-ICP torch [J Appl Phys 32:821–824, 1961]. Since then, the basic cylindrical design of the ICP torches presented by Reed has not changed. Cylindrical RF torches consume more gas and power than is needed for any process. The high consumption of gases is dictated by the need to prevent the torch from overheating and melting as the maximu Joule heating is close to the torch confinement tube.

The development of a conical torch, and its considerable advantages over cylindrical torches for material processing and for trace-e;ement analysis is presented in this talk. These advantages include substantially reducing gas flow rates (50%-70%) and power consumption (40%). In addition, maximum argon plasma temperature is over 1,000 K compared to cylindrical torches. The performance of the conical torch in ceramic powder processing, and in ICP-optical emission spectrometry is demonstrated.

Keywords: Radio-frequency inductively coupled plasma, conical torch, ceramic powder spheroidization, ICP-OES