Plasma Biology, Agriculture, and Environment Focus Topic
Room Hall B - Session PB-TuP

Plasma Biology, Agriculture, and Environment Focus Topic
Poster Session

PB-TuP-1 Detection of Metallic Ions in Solution Using Optical Emission Spectroscopy of Plasma Driven by Bipolar Pulsed Power Sources, ***Ching-Yu Wang***, *C Hsu,* National Taiwan University, Taiwan, Republic of China

Detection of metallic ions in solution using optical emission spectroscopy in plasmas offers advantages including simultaneous detection of multiple elements, minimization of cross-element interference, and rapid detection. In this work, plasma ignited in metallic-salt-containing-solution using bipolar pulsed DC power is studied. The goal is to understand how the modulation of the bipolar pulsed power influences the plasma optical emission of metallic elements. A power source that provides asymmetric bipolar voltage pulses of a duration between 10 µs to 100 ms with an amplitude up to ±1 kV is used. Plasma is ignited inside the gas-phase formed in the solution. The gas phase composes of water vapor, oxygen, and/or hydrogen through joule heating and/or electrolysis. The plasma behavior and therefore the optical emission are greatly influenced by the width, polarity, and amplitude of the bipolar pulses. Voltage and current probe are used to conduct electrical analysis; optical emission spectrometer and photo multiplier tube are used to perform time-averaged optical emission spectroscopy and time-resolved emission intensity, respectively.

While using repetitive 7500µs-widelow voltage pre-pulses followed by 100 µs-wide 600 V pulses to ignite plasma in solution consisting of 0.1 M HNO_3, 500 ppm Pb, and 250 ppm Na, we observe a low peak current with the application of the pre-pulse. The intensities and ratios of H, Pb, and Na emission lines are varied with different polarity and amplitude of the pre-pulse. The above observations show the modulation of the voltage pulses greatly influences the plasma behavior and therefore its optical emission. This work provides an effective way to tailor the plasma behavior and its optical emission, which could potentially be used as a strategy to obtain more reproducible and sensitive detection of metallic ion in water for analytical purposes.

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