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1 **Electron temperature and density measurement of a dielectric barrier discharge argon**
2 **plasma generated with tube-to-plate electrodes in water**

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9 **Abstract:** A dielectric barrier discharge argon plasma was generated with tube-to-plate
10 electrodes in the water by a sinusoidal excitation voltage at atmospheric pressure.
11 Time-averaged optical emission spectroscopy was used to measure the plasma parameters, of
12 which the rotational temperature of OH was obtained by comparing the simulated spectrum
13 with the measured spectrum at the $A^2\Sigma^+ \rightarrow X^2\Pi$ band transition and the electronic excitation
14 temperature was determined by Boltzmann's plot method. Furthermore, the emission intensity
15 ratio of atomic argon lines $\lambda = 811.5$ nm to $\lambda = 750.4$ nm was used to determine the electron
16 temperature and the Stark broadening of the hydrogen Balmer H_α line was applied to measure
17 the electron density. It has been found that the electron temperature and density in this argon
18 plasma were in the range of 1.02-1.43 eV and on the order of 10^{14} cm⁻³, respectively, and the
19 excitation temperature, rotational temperature, and electron density increase with the increase
20 of applied voltage. Besides, the properties of the argon dielectric barrier discharge were also
21 studied by electrical diagnosis.

22 **Keywords:** Dielectric barrier discharge, Conduction current, Electron temperature, Electron

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