Title : Investigation of Arc Plasma in Argon Carbon Dioxide Gas Mixtures

Author(s) :

1. Nicha Paochai — **Student ID :** 650510355
2. **Student ID :**
3. **Student ID :**

Major : Physics

Advisor(s) :

1. Professor Dr. Dheerawan Boonyawan
2.
3.

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ABSTRACT

This independent research aims to study the arc plasma of a mixed gas composed of argon and carbon dioxide. The experiment begins with the measurement of the relative intensity of light emitted during the arc plasma process using argon at a flow rate of 1 liter per minute(lpm). The flow rate is then increased to 2, 3, 4, 5, 6, 7, and 8 lpm. The spectra obtained from the relative intensity versus wavelength are used to calculate the electron temperature, which is subsequently plotted against the varying argon flow rates is analyzed using a Mobile Air Plasma Arc system. The study also explores the impact of replacing pure argon with a gas mixture of argon and carbon dioxide, beginning with 100 cc/min of carbon dioxide and varying argon flow rates, and extending to 500 cc/min of carbon dioxide. The objective of the study is to describe the influence of argon flow rates (1–8 lpm) as well as the effect of introducing carbon dioxide into the gas mixture. The experimental results indicate that as the flow rate of Argon (Ar) gas increased, the Electron Temperature (Te) exhibited a tendency to rise across all tested concentrations of Carbon Dioxide (CO2). The maximum Electron Temperature (Te) was specifically recorded at a CO2 flow rate of 400 cc/min in conjunction with an Ar flow rate of 8 lpm. Moreover, the study examines the effect of plasma treatment on the surface properties of materials, particularly changes in

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wettability, which are assessed through contact angle measurements. The experimental results reveal that the plasma arc surface treatment resulted in a significant enhancement of the material's wettability, evidenced by a substantial reduction in the contact angle from 42° to approximately 6°. Concurrently, the adhesion energy increased from 0.126 to 0.143 N/m. These findings definitively confirm that the Cold Plasma component of the arc system successfully modified the material surface to exhibit pronounced hydrophilic properties.

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