[I_1 — Intensity of the spectral line with the anode electrode (10 mm in the diameter) in the magnetic field, with Li_2CO_3 added and with the background correction.

I_0 — Intensity of the spectral line with the standard electrode 6 mm in diameter, without the magnetic field and without Li_2CO_3, with the background correction.

I — Intensity of the spectral line with the standard electrode 6 mm in diameter, without the magnetic field, with Li_2CO_3 and with the background correction.]

We examined the connection of these three defined amplifications as a function of the Li_2CO_3 added in the probe.

The other possibility for the amplification of the spectral lines of the elements in traces in the plasma consists in the application of the external magnetic fields. It has been demonstrated[1] that the application of the external magnetic field in the analysis of the ZnO_2 gives better results in the spectrochemical detection than the addition of Ga_2O_3.

The increase of the amplification of the spectral line intensities as a function of the concentration of lithium shows that the small effects caused by lithium are considerably amplified in the magnetic field. This may be connected with increase of the residence time of the particle in the plasma, and with the influence of the increased electron concentration of the equilibrium of the ionization processes of the atoms of elements in the plasma.

With higher concentration of the Li_2CO_3 the factor of amplification of the spectral line intensity in the magnetic field decreases. The decrease of the spectral line intensities in the presence of the magnetic field and larger quantities of the elements with low ionization potential may be explained by the fact that, although the intensity of the arc current are the same, the expansion of plasma no longer occurs.

Reference

1) V. Vukanović and V. Georgijević, Proc. XIV Col. Spec. Internationale, Debrecen (1967) p. 525

3.13 Spectrochemical determination of traces in the d.c. arc plasma as a function of arc current

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Abstract:

Recently the influence of the inhomogenous magnetic field on the amplification of the spectral line intensities in the d. c. arc plasma has been investigated [1, 2].

The amplification of the intensity I/I_0 can be defined as a ratio of the intensity of the spectral lines measured in the plasma with the magnetic field and without magnetic field, both with background corrections.

This paper shows the investigations of optimal conditions of the amplification of the spectral line as a function of the arc current.

The ratio I/I_0 shows a very selective dependence on the arc current having the maximum at 12 A.

To explain this dependence following measurements were realised:

a) By the photographic metod we obtained the projection area of the arc burning with different arc currents. The maximum was at the value of 12 A.

b) The high speed camera method gives the dependence of the frequency on the arc current. Taking current values between 6 and 16 A the frequency changed from 100 to 600 Hz.

c) The measurement of the background intensity near the spectral line as a function of the arc current shows an increase with the current.

The previous measurements show that the intensity of the spectral line increases with the volume of the plasma and opposite. The increase of the plasma volume can be connected with the increase of the residence time of particles, which results in an increase of the spectral line intensity.

The decrease of the plasma volume can be connected with higher centrifugal force and with the increase of the background.

References

1) V. Vukanović, V. Georgijević, D. Vukanović and M. Todorović, Spectrochemica Acta **24 B** (1969) 555;

2) M. Todorović, V. Vukanović and V. Georgijević, Spectrochemica Acta **24B** (1969) 571.

3.14 Influence of iodine vapour on the radial temperature distribution of the arc burning in the atmosphere of nitrogen and argon

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In some earlier papers[1, 2, 3, 4]) we have discussed the influence of the arc atmosphere components on the radial temperature distribution. Our considerations were made in terms of the Elenbaas-Heller equation for the energy balance of plasma

$$\sigma(T)\,E^2 = -\frac{1}{r}\,\frac{\mathrm{d}}{\mathrm{d}r}\left(r\,\varkappa\,\frac{\mathrm{d}T}{\mathrm{d}r}\right), \qquad (1)$$

where σ is the electrical conductivity, E the axial electrical field strength, r the radial coordinate, $\varkappa$ the heat conductivity, and T the temperature.

An essential fact in the energy balance of plasma is the effect of chemical reactions among the components of the arc atmosphere on the heat conductivity of the arc plasma. The total heat conductivity $\varkappa$ is made up of several parts, i. e.

$$\varkappa = \varkappa_n + \varkappa_r + \varkappa_t, \qquad (2)$$

where $\varkappa_n$ is the classical heat conductivity, $\varkappa_r$ the heat conductivity due to the transport of reaction energy, and $\varkappa_t$ the heat conductivity due to the thermal diffusion. The contribution of $\varkappa_r$ to the total heat conductivity is by far the greatest one, and therefore, the radial distribution of temperature in the arc plasma depends essentially on the chemical reactions of the plasma components.

To bring out this statement more distinctly, we considered the effect of the reaction energy on the radial temperature distribution using a series of ideal theo-