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PECULIARITIES OF OPTICAL EMISSION SPECTROSCOPY OF COPPER-CHROMIUM-AIR PLASMA

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Abstract. This work is devoted to the peculiarities of optical emission spectroscopy of plasma of electric arc discharge between Cu-Cr composite electrodes manufactured by pressing and sintering technologies at different temperatures, namely: 650, 750, 850, 950, 1050 and 1150°C. The investigations are carried out at arc current of 3.5 A. The comparison of radial distributions of plasma temperatures, which were determined by Boltzmann plot technique both on the base of Cu I and Cr I spectral lines, are performed and discussed.

Results. As an example, Fig. 1 shows the radial distribution of excitation temperatures in the plasma of electric arc discharge between composite Cu-Cr35% (a, b) and Cu-Cr65% (c, d) electrodes, which were pressed and sintered at 750°C (a, c) and 1050°C (b, d).

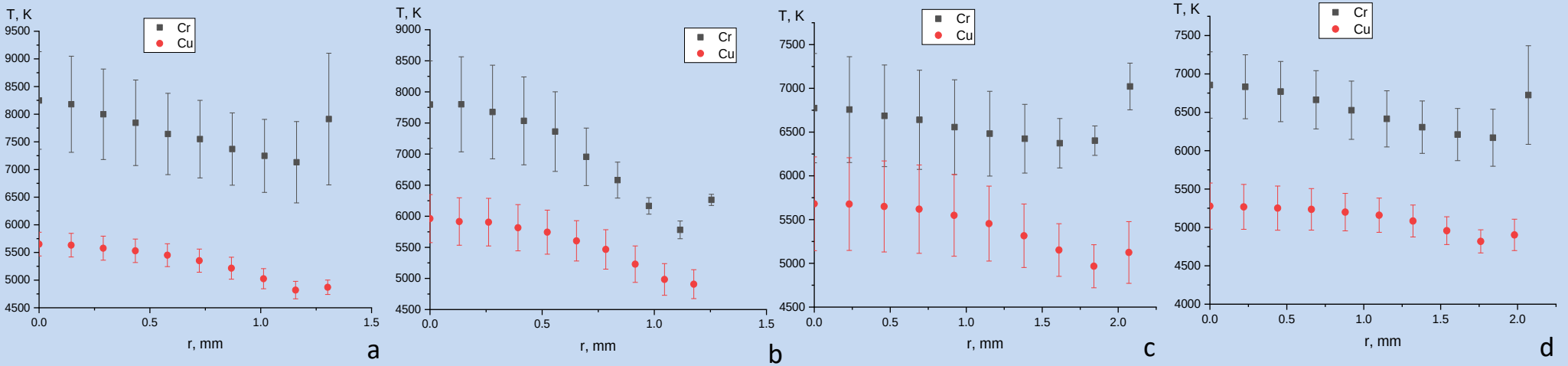

Fig. 1 Radial distributions of excitation temperature of copper (red dots) and chromium (black dots) atoms in plasma of electric arc discharge between composite Cu-Cr electrodes, pressed and sintered at temperature of 750°C (a, c) and 1050°C (b, d): volume fraction of chromium is 35% (a, b) and 65% (c, d)

Summary. As one can see, the temperatures, obtained by Boltzmann plot technique on the base of both Cu I and Cr I spectral lines, are different, therefore, it may indicates that the air plasma with copper and chromium vapour admixtures is not isothermal. Namely, the excitation temperature of chromium atoms is larger compared to excitation temperature of copper atoms in each kind of plasma, namely in the cases of different stoichiometry of electrodes and variety fabrication conditions of this composites manufacturing. Due to it, it is not possible to determine the concentration of metals in such discharge gaps, since this determination should be made on the assumption of local thermodynamic equilibrium.

Thus, it is necessary to investigate in detail the elementary process (e.g. elastic and inelastic collisions) to understand this phenomenon as well as to developed a new technique of estimation of quantity of metal vapours in plasma of electric arc discharge between Cu-Cr composite electrodes in order to estimate the erosion resistance of such composites.