MICRON-SIZED COPPER AND TUNGSTEN CONDUCTOR MECHANISMS OF DESTRUCTION DURING THE HIGH VOLTAGE SOURCE WITH THE SUBNANOSECOND PULSE FRONT DISCHARGE TO AN INHOMOGENEOUS COAXIAL LINE. PLASMA CHANNEL STRUCTURE.

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During the high current generator nanosecond discharge to the microwires of refractory (like tungsten) and fusible (like aluminum or cooper) metals the structure of the plasma channels resulting from the electric explosion of conductors (EEC) varies essentially. For refractory metals the plasma crown "intercepting" the whole current of the charge is generated, and for fusible ones plasma crown is absent. Thus there is the question: what roles the surface phenomena and, in particular, the thermal-field emission plays in plasma crown generation and in microwires destruction, and is there any plasma crown generation during the discharge to the microwires of fusible metals? The main goal of the suggested work is the experimental investigation of the given question.

In our experiments high-voltage impulse generator "RADAN - 220" with the characteristic impedance of 50Ω was discharged to the inhomogeneous coaxial line (vacuum camera), where to the center conductor there were placed 5 mm microwires of Cu ($20\ \mu\mathrm{m}$ in diameter) and W ($24.5\ \mu\mathrm{m}$ in diameter). Voltage pulse amplitude was of about $220\ \mathrm{kV}$; pulse rise time $-200-500\ \mathrm{ps}$; energy stored in the generator $-1\ \mathrm{J}$. Pressure in the camera varied from $10^{-4}\ \mathrm{mm\ Hg}$ to $1\ \mathrm{atm}$. The input voltage in the vacuum camera was measured via the capacitance voltage divider installed into the vacuum oil, and the electric current via shunt. Signals from both shunt and divider were registered by the four-channel digital Tektronix oscilloscope with $1\ \mathrm{GHz}$ bandwidth. It is revealed that the maximal current value is defined by the effective characteristic impedance and reaches $2.2\ \mathrm{kA}$. It is also shown that for same conditions the form of the current does not virtually depend on the microwire material. Together with the oscilloscope measurement the integral survey of the discharge via the DSLR camera Canon 450D and super close-up rings system was carried out. The discharge continuous sweep survey via the AGAT "SF-3M" camera, integral spectrum registration via the MS 257 spectrograph and the electron microscopy of the surface of the exploded microwires tails were also carried out.

It has been experimentally found that the microwires destruction process depends on the ambient gas pressure and on the thermal-field processes at the surface of microwires with current. The integral pictures of the discharge show the channel structure to be essentially not one-dimensional, and also vortex and helical structures, clear luminous points and plasma (electron) jets presence. It has been revealed that there is a reduced pressures range (W microwires have a wide range than Cu ones) where there is no microwire destruction. The range divides two regions with different destruction mechanisms with different corresponding oscilloscope records of current waveforms. In the pressure range close to the atmospheric microwires seem to destruct as a result of its interaction with the plasma crown of the gas discharge along the microwire surface. Within the range $P \sim 10^{-4} - 10^{-2}\ \mathrm{mm\ Hg}$ microwires are destructed mainly via EEC. Within the transitional region microwires destruction depends on leak currents induced by the thermal-field emission processes, allocation resulting from electromagnetic energy irregularity, electron beams and plasma jets formation. In the high vacuum range thermal-field processes at the microwires surface also affect the process of formation of the channel and its structure, which is shown by the process of destruction dependence of the voltage polarity at the microwire.

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