# PHOTOGRAPHIC RESEARCH OF THIN METAL FILM ELECTRIC EXPLOSION EXPANSION INTO A FREE SPACE*

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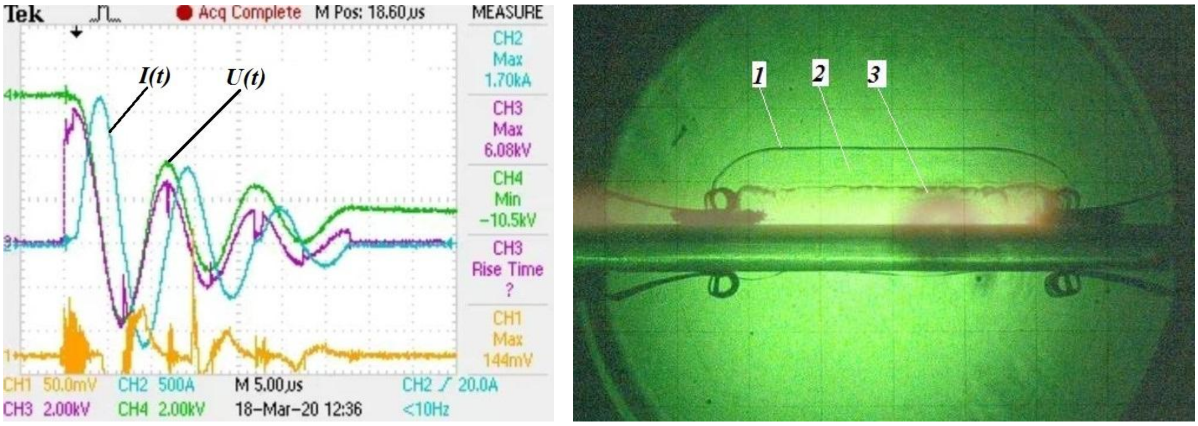
The paper presents the results of thin metal film electric explosion [1] dynamics and explosion products expansion in the mode of slow energy input into a free space. Electric explosion of thin metal films [2] nowadays found application for determination different materials thermophysical properties under the extreme conditions [3]. However, the main goal of those investigations is to find out the values of different material properties excluding studying the process of explosion.

Applied in experimental studies films (Cu, Ti) were received by the method of magnetron sputtering on quartz glass (20x50 mm), their thickness was 40 nm, electrical resistance – 100…130 Ohm. A power circuit [4] included a pulsed capacitor $C_0 = 0.6$ μF charged up to 8…30 J ($U_0$=5.0÷8.0 kV) through an electrical ballast $R_b$ =10 kΩ. The circuit commutation was fulfilled with a quick-acting thyratron module. The studies were performed in inert argon atmosphere with the pressure of ≈ 1 bar.

Current $I(t)$ and voltage $U(t)$ waveforms (fig. a) were registered by current monitor and voltage dividers. Maximum value of the current reached $I_{max}$=1,1 – 1,5 kA, time of the process τ=50…70 μs.




a b

Current $I(t)$ and voltage $U(t)$ waveforms (a) and Schlieren picture of Ti film explosion (b)

Two methods of optical diagnostics were used for the explosion process visualization: method of direct photography with a high – speed camera and method of shadow photography (schlieren scheme in light field mode). The laser beam was produced by the Nd-YAG laser with $\lambda_2$ = 532 nm and τ = 10 ns. Setting a fixed delay for laser operation allowed to receive data abot the explosion process in difeerent moments of time: from 5 μs to 70 μs.

Typical schlieren picture of Ti film explosion is shown on fig. 1b. There were visualized areas of a generated shock wave front (1), a shock compressed gas area (2) and an extended high temperature explosion products (3).

## REFERENCES

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