Registration of the shock wave emergence on a free metal surface using an electrical probe

Kulish M I, Dudin S V[@], Ushnurtsev A E and Mintsev V B

Institute of Problems of Chemical Physics of the Russian Academy of Sciences, Academician Semenov Avenue 1, Chernogolovka, Moscow Region 142432, Russia

[@] dudinsv@ficp.ac.ru

When the shock wave leaves the surface of the body, the compressed matter is unloaded to nearly zero pressure. During adiabatic unloading of the body to the initial, pressure, it turns out to be heated and expanded compared to the initial state, i.e., before the shock wave compression. The radiation power of the body increases rapidly with temperature, and at temperatures T = 1000 K radiation can be registered by photodiodes in the visible and infrared spectral region limited by the wavelength $\leq$ 2000 nm, in a dynamic experiment at a time resolution of 10 ns. The observed emission features can be explained by the fact that the emission of individual superheated particles ejected from the surface or the emission of hot spots on the target surface is registered. In the problem of gas-dynamic fusion initiation, particle ejection and surface instability are factors that significantly reduce the plasma temperature and prevent fuel ignition. In our experiments, the optical registration of the shock-wave exit to the free surface was supplemented by measuring the current of an electrode located near the target surface in vacuum. An initial negative bias voltage was applied to the electrode. In the experiments, the conductivity of the plasma ejected along with the particles from the surface of the target and the conductivity signal arising at the moment when the wave enters the surface were recorded. A possible explanation for this effect could be photoelectric emission of electrons from the probe surface.