

Effect of target irradiation on the parameters of laser produced plasma ions

R. T. Khaydarov, H. B. Beisinbaeva, M. M. Sabitov, V. B. Terentev and G.R. Berdiyev

Institute of Applied Physics, National University of Uzbekistan

E-mail: rkhaydarov@nuuz.uzsci.net and rtkhaydarov@yahoo.com.ph

Intense pulsed heavy ion beams have been attracting a lot attention in past few years due to their possible applications in, e.g., materials processing including surface modification, thin film deposition, ablation of solid targets, non-equilibrium plasma production. Such high energy and charge state ion beams also present remarkable interest in fundamental and applied nuclear physics research. An example is the possibility to generate non-equilibrium plasma in a vacuum in order to obtain very high and very fast electric field transients, useful to accelerate ions [1]. Plasma ions can also be used for heavy ion driven plasma research – the production and injection of ion streams into ion sources so that high currents and charge states can be extracted for post acceleration [2]. For the ion implantations it is important to generate high-purity ion beams with various ion species. Recently, a magnetically insulated ion diode has been developed [3] using vacuum arc plasma gun to generate such pulsed metallic ion streams. In inertial confinement fusion scenario the main requirements for the ion source are i) 10^{13} - 10^{14} ions per pulse, ii) long-pulse over 1 μ s, and 3) low charge state [4,6,]. These requirements are met by laser ion sources based on the pulsed laser ablation process [2].

Therefore, in this work we study the effect of structural defect levels in crystal targets on the threshold and morphology of destruction of the targets during the interaction of intense laser radiation with target surface. We also study the characteristics of plasma ion formation from the target. We show that structural changes in irradiated Al targets have an influence not only on the efficiency of the process of material evaporation and emission of plasma bunch, but also on the efficiency of ionization and recombination processes, which takes place in the plasma bunch on the stage of formation and expansion.

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