Laser-Driven Heavy and Light Ion Acceleration from Thin Foils Heated by CW Laser


Russian Federal Nuclear Center – Zababakhin All-Russia Research Institute of Technical Physics (RFNC-VNIITF), Snezhinsk, Russia

A method for in-situ target surface cleaning by CW laser was developed to increase efficiency of heavy-ion acceleration. Temperature of target under irradiation was controlled by its thermal spectrum. On 30 TW picosecond laser facility “Sokol-P” there were conducted experiments on ion acceleration from heated titanium and tantalum foils of 1 μm thickness. Influence of target temperature on proton energy and yield was deduced. Heating allowed increasing of light ions energy up to 2.5 times – carbon and oxygen ions were accelerated to more than 5 MeV/nucleon. Cut-off energy of tantalum ions constituted 47 MeV (corresponds to Linear Energy Transfer in silicon of 35 MeV·mg/cm²).

In addition experiments on deuteron acceleration from heated TiD₂ foils were carried out. Deuterons with energies up to 6 MeV were registered. Laser energy conversion into fast deuterons constituted 0.04%. These results can be used to create clean laser source of fast tritium ions.