Formation of collimated ion beams with sub-relativistic femtosecond laser pulse using 2D microstructured foils

Abstract.

High-temperature plasma formed as a result of interaction of high power femtosecond laser impulse with matter. This plasma is the source of x-ray radiation, high energy ions and electrons. The characteristics of the resulting ions depend on the parameters of the laser system and on the parameters of target used.

The target mount and the target from aluminum foil was made. Emanation of the target from focus while moving in perpendicular to laser beam direction was less then $40\ mkm$. The $10\ mkm$ holes were made in this target, using the second harmonics of Nd:YAG laser (532 nm).

Furthermore, time-of-flight ionic spectrometer with magnetic separator was created and ionic currents were measured. In this experiments, Ti:Sa laser (800 nm) with intensity $I = 0{,}2 \div 6 * 10^{18} W/cm^2$ was used. The target was a thick iron plate. As a result, oxygen and iron ions were identified, necessity of this devise was shown and magnetic induction was estimated as $B = 0{,}54 \pm 0{,}05\ Tl$.

Another result of this work was confirmation of the fact, that maximum ionic energy weekly depends on impulse duration in the interval $40 \div 1500\ fs$. But if impulse duration is minimum (40 fs), maximum ionic energy is lesser, than for longer pulses from the interval, written above.