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"Table-top" picosecond accelerator of super-dense electron-ion beams

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The extreme operating mode of a "table-top" (diameter 120 mm, length 350 mm) high-voltage (U = 280 keV) high-current (I = 5 kA) electron accelerator with a beam duration of 200 ps is investigated. The luminescent method shows that the beam diameter in the uniform pinching mode is about a micrometer, and the beam contains electrons with an energy exceeding 400 keV, which are about 1/4 of the total number of electrons in the beam. Result of the analysis of the bremsstrahlung X-ray spectrum of the beam electrons is consistent with this data with satisfactory accuracy. Also, it is established that the ions of the cathode material Tin+ captured by the electron beam are accelerated up to an energy of ≤ 10 MeV, and the ion fluence reaches 10^{17} ion cm^{-2} in the pulse. These ions are effectively embedded into the lattice sites of the irradiated substrate (sapphire crystal), forming the luminescent areas of the micron scale.

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