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Conditions and design options for the target formation device for generating X-ray radiation

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To increase the density of chip elements during photolithography, it is proposed to use laser-plasma sources during optical breakdown. The highest efficiency of generating radiation in the X-ray range at a wavelength of 6.7 nm is achieved by using plasma of refractory rare-earth elements such as gadolinium and terbium in the gas phase. The article discusses the main parameters and options for constructing a target formation device for optical breakdown based on an analogue, an electric arc plasma source using alkali metal vapor. A study of the device requirements was conducted, and thermo- and gas-dynamic calculations and assessments were performed. It was proposed to use an electron beam generator based on an open discharge in a buffer gas as a heater. Calculations were performed for the electron path length and energy density. Estimates were made of the energy efficiency of creating a target by heating the device with an electron beam.

Keywords: ultraviolet and X-ray photolithography, target formation device, plasma-laser sources, optical discharge, arc plasma generator, plasmatron, electron gun, open discharge, runaway electrons, flow parameters, electron energy release density, electrons mean path, energy efficiency.

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