Capillary discharge-driven metal vapor plasma waveguides

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Abstract

We report the generation of dense plasma waveguides containing a large concentration of silver ions by means of a fast (~ 55 ns first half-cycle) micro-capillary discharge. Concave plasma density profiles with axial electron density > 1×10^{19} cm^{-3} were measured from discharge ablation of 330 or 440 μm diameter Ag_2S capillaries with 3-5 kA peak amplitude current pulses. The dynamic of this plasma waveguide was studied with interferometry, absorption measurements, and hydrodynamic model simulations. The results are relevant to the development of efficient longitudinally pumped metal vapor soft x-ray lasers, in particular those employing transient excitation of Ni-like ions. An approach to the design of a gain saturated waveguided 13.9 nm laser in Ni-like Ag is discussed.

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