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FEATURES OF LASER PRODUCED ANNULAR PLASMAS USING DIFFERENT TARGET MATERIALS AND AMBIENT CONDITIONS

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We have been studying the dynamics and overall features of laser produced annular plasma expanding in background gases. The initial plasma is produced by focusing a Nd:YAG laser beam (1064 nm, 3.5 ns FWHM, $\sim 10^{10}$W/cm^2) onto a flat target employing a combination of a 10 mrad axicon prism and a converging lens, which results in an initial ring-like shape plasma of 1 mm radius and ~150 μm thickness. Previous observations using 3.5 ns shadowgraphy imaging at background pressures up to 1.0 atm Argon background indicate that the plasma propagates inwards with characteristic velocities $\sim 10^4 - 10^5$ m/s, depending on pressure. This is then followed by on axis stagnation and formation of a jet-like column. The resulting plasma expands both, radial and axially, being the expansion dynamic very well described by the drag model. As a result of on-axis stagnation, initial axial velocity is higher than initial radial velocity. Subsequent plasma axial plasma expansion leads to the formation of a blast wave with a non-spherically symmetric shock, with a bubble-like feature on-axis. 3.5 ns Mach-Zhender interferometric observations indicate that at all observed times and pressures the innermost region behind the shock is always filled with plasma. In order to get further insight into the overall plasma features we have investigated the plasma dynamics using different target materials, carbon, aluminium and copper. We have also used Faraday cups to characterize ion beams emitted along the initial stages of the annular plasmas. Based on these observations, a quantitative description of the dynamics of laser produced annular plasmas, over a wide set of parameters, will be presented.
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