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Interpenetration and Stagnation in Collapsing Plasma's

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Future inertial fusion reactors are supposed to work with long pulses or with high repetition rates using repeated pellet implosions. In such extreme environments, the reactor wall materials will be disclosed to short X-ray pulses and fusion generated fragments. This will cause ablation to the wall material in the form of plasma that is expected to collide with each other in the center of the chamber or interpenetrate to elsewhere within the reactor chamber. In this work, a laboratory experimental setup; is devoted to use colliding plasmas scheme to investigate the collision effects similar to plasma facing components in fusion reactors.

Different materials were used for these collapsing plasma experiments for controlling the velocity of plasma plumes. A special experimental setup was built where the laser is focused into a line-like shape impinged as two perpendicular beams onto a semi-circular target. The setup was carefully built to force the seed plasmas to collapse in the center of the chamber prior to the colliding process. The interpenetration and stagnation layer, if exists, of plasmas of candidate fusion wall materials, viz., carbon and tungsten, and other materials, viz., aluminum, and molybdenum were investigated in this study. While tungsten plumes interpenetrate each other at the colliding interface, carbon colliding plumes formed a strong stagnation layer, which could be a source of nanoparticles and plasma aerosols generation that may hinder fusion high repletion rates.

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