Investigations of hydrodynamic, absorption and radiative properties of X-ray heated low density foams for experiments on heavy ion stopping in plasmas.

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The unique combination of a Petawatt High-Energy Laser System for Ion beam eXperiments – "Phelix" (Nd:glass) and heavy ion beams of the UNILAC accelerator at Gesellschaft für Schwerionenforschung, Darmstadt, Germany allows investigation of the heavy ion stopping in dense laser produced plasmas. In order to gain high degree of homogeneity and approach plasma with a coupling parameter $\Gamma \sim 0.5\text{-}1$ a combined hohlraum-target concept have been investigated, where the cold matter is heated volumetrically by means of X-rays generated in the gold hohlraum. The application of low density CHO-foam layers for plasma production has demonstrated very high hydrodynamic stability and uniformity of plasma compared to the solid density foils of the same areal density, which expands after heating by X-rays in sub-nanosecond time scale creating plasma with high temperature and density gradients. Results of experiments [1] carried out at GSI-Darmstadt and PALS-laser facility in Prague will be presented, where a wide verity of diagnostic methods have been applied. Measurements on the thermal wave propagation, opacity, self-radiation and heavy ion-stopping properties of plasma heated by means of soft X-ray hohlraum radiation will be discussed. Numerical simulations of hydrodynamic and radiation properties of CHO-plasmas heated by means of hohlraum radiation [2, 3, 4] show good agreement with experimental results.

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