Study on the generation of a preplasma for a triple layer target to enhance hot electron generation

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Most common experiments for the ion acceleration use shot pulse, high-power lasers. The main high power pulse is accompanied by a nanosecond pedestal due to the amplified spontaneous emission (ASE), and a picosecond pedestal due to the unaviodable limit in chirped pulse amplificatin (CAP) techinque. These two precursors generate the underdence preplasmas before the main pulse arrives at the target surface. The preplasma increases the absorption of the laser energy, thereby increasing the temperature of fast electrons and the energy of accelerated ions. With a preplasma of which maixmum density is close to the ciritcal density of laser pulse, the accelerated ion energy has been enhanced more than compared with the case without perplasma.

However, when the prepulse irradiates on a foil target, the rear side of the target is also distorted due to a shockwave propagated from the front surface, thus removing sharp density gradient, which is rqruired to build a strong shath field according to TNSA (Target Normal Sheath Acceleration) model. In order to resolve this problem, we considered a triple layer target, which is composed of a preplasma generation part (thin metal), vacuum layer and a proton generation part (metal or plastic). The preplasma generation on this target was calculated by using a two-dimensional MULTI code. We will present how the preplasma is generated and affects the target surface for proton generation.