MAGNTOHYDRODYNAMIC BEHAVIOR OF LASER CAPACITOR TARGET TOWARD ALTERNATIVE INERTIAL CONFINEMENT FUSION

T. Sasaki[1], S. Oyama[1], Y. Sugimoto[1], K. Takahashi[1], T. Kikuchi[1], N. Harada[1], H. Nagatomo[2], S. Fujioka[2], and A. Sunahara[3]

[1]Nagaoka University of Technology, Nagaoka, Niigata, Japan

[2]Osaka University, Suita, Osaka, Japan

[3]Institute of Laser Technology, Osaka, Osaka, Japan

Contact Author: sasakit@vos.nagaokaut.ac.jp

Critical to fast ignition is the transport of the laser-generated fast electrons and their associated heating of compressed DT fuel. The coupling efficiency of laser energy to these fast electrons and the energy deposited in the fuel should be improved the guiding method. The fast electrons are transported with the strong magnetic field, which is order of several teslas, generated by a laser capacitor target [1]. The generated magnetic field using laser capacitor target depends on the coil materials. The generated magnetic filed should be considered the generation rate of fast electrons and the skin effect as an electrical conductivity for ablated plasma at the generation of the magnetic field. To understand its magnetohydrodynamic behaviors and the electrical properties, we proposed to evaluate experimental observations and numerical simulation.

To understand the efficient B-field generation with the coil-capacitor target, we have evaluated the electrical conductivity for several matters in warm dense state [2-4]. The time-evolution of the electrical conductivity for the coil/plasma with expansion is key parameter due to determination of the maximum current in coil/plasma. From the comparison of the electrical conductivities in warm dense state, warm dense copper and aluminum are similar density dependence at the constant temperature. The electrical conductivity in warm dense gold is one-tenth smaller than that in warm dense copper or aluminum. On the other hand, the electrical conductivity of nickel is relatively higher than that of the other materials. From the experimental observations, the skin effect in the coil for the warm dense state is small and the total resistance of coil/plasma is important.

To understand the magnetohydrodynamic behavior in the laser capacitor target, a two-dimensional MHD simulation has been demonstrated. The simulation includes the conventional theoretical models. The results indicated that the skin effect occurs at the initial condition of the laser capacitor target. Its magnethydrodynamic behavior and the material dependence for the laser capacitor target will be discussed.

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