INPUT ENERGY MEASUREMENT TOWARD WARM DENSE MATTER GENERATION USING INTENSE PULSED POWER GENERATOR

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In inertial confinement fusion (ICF), the structural materials in the fuel pellet become dense plasma through the warm dense matter (WDM) region, which is in density from 10^{21} to 10^{24} cm^{-3} and for temperature varying from 10^3 to 10^5 K. The WDM is complex regime, because of unclear theoretical model, and lacked experimental evaluations. Therefore, to predict the implosion dynamics, properties in WDM such as the equation of state, the electrical conductivity and the specific heat are required. In addition, to suppress the implosion non-uniformity, a foamed metal is used for the pusher and the radiator [1]. The accurate properties of matter are required for evaluating ICF with the implosion time scale, because the properties are not well known.

In previous studies, a short pulse laser and a pulsed power discharge were used for the generation of WDM [2,3]. In order to investigate the specific heat of WDM in ICF, the evaluation method for the WDM with isochoric heating [4] on the implosion time scale using an intense pulsed power generator ETIGO-II (~1 TW, ~50 ns) [5] has been considered [6]. In this study, the input energy into a sample is measured from the voltage and the current waveforms.

Figure 1 shows the measurement setup for time-evolution of input energy into the sample for the estimation of specific heat. The sample is placed behind an electron beam diode, which is an impedance controller [7], and is grounded to the outer feeder. The voltages are measured using resistive dividers before and behind the sample. Time evolution of the current $I(t)$ is measured with a Rogowski coil. Time evolution of the voltage $V(t)$ and the input energy $E(t)$ into the sample are measured to be $V(t)=V_1(t)-V_2(t)$, $E(t)=\int V(t)I(t)\,dt$, where $V_1(t)$ is the voltage at the ground, $V_2(t)$ is the voltage between the sample and ground. According to the above measurements, the input energy into a sample is obtained. The input energy is used for the estimation of specific heat of WDM.

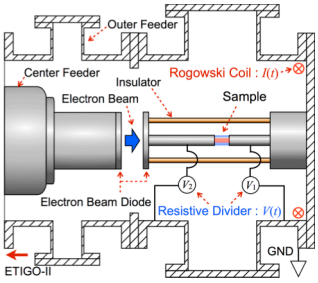

Figure 1. Measurement setup for input energy into sample.

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