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IFE/P6-13: 10-J Green DPSSL-pumped Laser System HAMA for High-repetitive Counter Irradiation Fast Heating Fusion Demonstration

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The achievement of controlled fusion burn and gain with single-shot mega-joule-class laser such as National Ignition Facility (NIF) is scheduled within a few years. Following this scientific proof of ignition, inertial fusion energy (IFE) needs to start engineering development based on repetitive mode experiment. In this engineering phase, development of IFE driver has the first priority because energy or power of IFE driver decides the design and size of IFE experiment machine. A diode pumped solid-state laser (DPSSL) is a promising candidate of the reactor driver for IFE because we can operate it at a high repetition rate (>10 Hz) with high efficiency (>10 %). Based on available DPSSL represented by HALNA and Mercury, we can develop a repetitive IFE experiment machine by including the other indispensable IFE technologies of target injection and energy conversion system in hand. This is the promising pass to realize the power plant step by step. Here, we developed a DPSSL-pumped laser HAMA to demonstrate repetitive fast heating ICF fusion in which both implosion and heating pulse are required. Demonstration of fast heating scheme requires an ultra-intense laser around 10ˆ18 W/cmˆ2. The present DPSSL provide energy around 10-J class, however, they are not high intense to demonstrate the heating. Applied DPPSL as Ti:Sappihre pumping is a convenient way to demonstrate implosion and heating because it can activate short pulse duration. To demonstrate a counter irradiation fast heating fusion scheme, amplified chirped pulse of 4 J/0.4 ns is divided into four beams, two for imploding and the others for heating the imploded core. The energy is 0.5 J each and intensities are 5.9 x 10ˆ13 and 1.9 x 10ˆ17 W/cmˆ2, respectively. These intensities are within the scope of fast heating fusion experiments. HAMA succeeded in generation of 10ˆ3 DD neutrons/shot by fast heating scheme in repetitive experiments. This is the first demonstration that 10-J class DPPSL is adapted to repetitive ICF experiments. Based on HAMA, we can construct a repetitive ICF experiment machine by including target injection and tracking. In this presentation, we will describe the detail setup of HAMA including laser irradiation system.

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