Tomomasa Ohkubo, J Laser Opt Photonics 2017, 4:2(Suppl)
DOI: 10.4172/2469-410X-C1-012

Development of 100 W-class solar-pumped laser system

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We developed solar-pumped laser system with Fresnel lens and solar cavity. The output power of the laser system was 120 W and the collection efficiency was 30W/m^2. To keep the global environment, we must develop renewable energy systems, which replaces energy system with fossil fuels. Solar-pumped laser is one of a promising new technology to utilize solar energy for our society. For example, laser space solar power systems (L-SSPS) is proposed by Japan Aerospace Exploration Agency. L-SSPS proposes transmission of collected solar energy in the space to the earth by solar-pumped laser. In addition, energy cycle using magnesium as energy career is proposed by Yabe *et al*. Solar-pumped laser is expected as an energy source of reduction of magnesium in this energy cycle. We designed 2 m x 2 m of Fresnel lens to realize high power concentration of solar energy. Nd:YAG single crystal or Cr:Nd:YAG ceramic was used as laser medium. Whole system is installed on a Sun tracking system to realize continuous lasing. Using these equipment, we developed several type of solar cavity to confine solar energy and make it absorbed by laser medium. 80 W of peak output was realized as shown in green line in Figure 1 by a solar cavity, which is cone-shaped inner mirror holding laser medium at that of the central axis. 80 W of stable laser output was realized as shown in red line in Figure 1 by solar cavity, which is combined cone-shaped solar cavity and compound parabolic mirror (CPC). Furthermore, 120 W of stable output was realized using cone-shaped cavity and glass tube filled with water surrounding the laser medium. We called this system as liquid light-guide lens (LLGL) because the water works not only as coolant but also as a refractive optics.

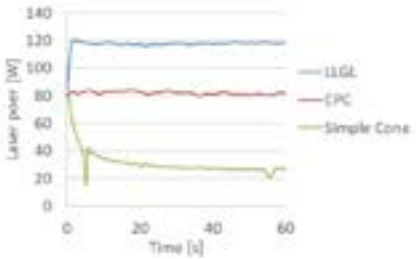

Figure1: Time development of laser output using each solar cavity. 80 W of peak power was realized using simple cone shape cavity and 80 W of stable output is realized using CPC. 120 W of stable laser output was realized with LLGL.

Biography

Tomomasa Ohkubo has his expertise in development of solar-pumped laser and numerical analysis of laser processing. He has completed his PhD from Tokyo Institute of Technology. He is Senior Assistant Professor of Department of Mechanical Engineering at Tokyo University of Technology. He is also Senior Assistant Professor of Department of Media Science at Tokyo University of Technology.

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