

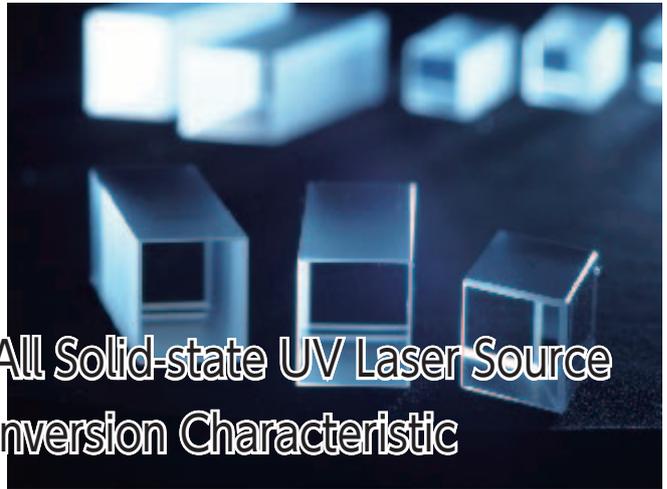


December 2013

Osaka University Kogakugiken Corp.

· Research and Development for Photon Measurement and Processing/High-light-concentration All-solid-state Laser Technology(FY1997-2001)and others

World's First Realization of an All Solid-state UV Laser Source with Advanced Waver-length Conversion Characteristic

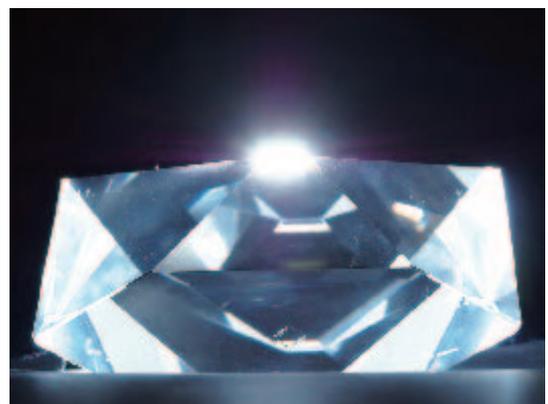


Various digital devices, communication devices, automobiles, and medical equipment around us are supported by high-density, high-integration semiconductor integrated circuits (LSIs), and ultrafine measurement and processing with lasers are critical for manufacturing processes of the semiconductors.

In the current semiconductor industry, an UV laser with short wave length, high workability, and high light concentration are needed for cutting, processing, and measuring objects. For semiconductor exposure processes, a laser with mixed gases (excimer laser) is widely used. However the excimer laser uses toxic gases such as Ar or F and requires large equipment and maintenance cost. Also its laser quality is rather low and the energy conversion efficiency is low.

Sasaki Takatomo, professor emeritus at Osaka University, and Mori Yusuke, professor at Osaka University, discovered CLBO crystal which had an advantage in the wave length conversion from infrared radiation to ultraviolet radiation. For the development of the crystal, they participated in NEDO's "Research and development for photon measurement and processing" to establish a high-quality CLBO crystal growing technology. They also established a crystal grinding and processing technology together with "Kogakugiken Corp." in Atsugi, Kanagawa Prefecture, Japan. As a result they could produce "an all solid-state UV laser source device (CLBO wave length conversion device)" whose energy conversion efficiency was about five times higher than the conventional excimer laser.

The developed CLBO wave length conversion device began to be sold by Kogakugiken Corp. in April 1996, and now takes up 100% share in the solid-state UV laser market in the world.



CLBO crystal grown to 400g



Heated, stirred melting pot used with solution stirring method



Very delicate crystal, packed for delivery to avoid exposure to air

Q. Why did this project start?

In 1997, when this project started, people in the United States, Germany and other European and North American countries began to recognize the importance and potential of the photon (laser) technologies and industry-academic-government projects on the technologies were launched in these countries with large funds. In Japan, under an industrial policy for the strengthening of fundamental industrial technologies, promotion of fostering of advanced industry, and enhancement of international competitiveness of the manufacturing industry, this project was started through collaboration between industry, academia and government to establish a photon technology for its application to not only the manufacturing industry but also a variety of industries.

Q. What was the aim of the project?

For significant enhancement of the energy use efficiency, productivity, and product reliability of the manufacturing industry, basic and fundamental research and development have been conducted by formally introducing a new tool, i.e. photon, to establish an advanced measurement technology and processing technology with photon beams and a high-quality photon beam generation technology. As a part of the project, "high-light-concentration all-solid-state laser technology" was aimed at in the development of an ultraviolet light generation technology using a wave length conversion crystal. High power (20W, much larger than the world-class power of 10W at that time) ultraviolet light was the target of the project.

Q. What is the role of NEDO?

In order to set a goal of the project, a research trend survey was conducted in FY1993 and preliminary research was made for three years from FY1994 to find the current status of the technologies, applications and needs of the technologies, and market size. The project was planned and designed based on these studies. NEDO established "Photon measurement and processing technology promotion committee (with meetings held twice a year)" within the organization to give advice on the appropriateness of the goal, promotion of the research and development, response to interim assessment results, and verification of final achievement of the project goal. It also participated in the NEDO business debrief sessions, announced at a press conference, and submitted articles to "Focus NEDO" for the dissemination of the project results.