

High Power UV Laser for High Speed Material Processing



Technology Overview

Laser scribing has many advantages over mechanical scribing including higher throughput and yield, lower maintenance cost and smaller scribe width. In particular, UV laser, as compared to IR or green, is a better laser source due to its higher energy absorption by most semiconductor materials, leading to a more effective material removal rate. Its natural high photon energy also offers cold material processing: the smaller heat-affected-zone (HAZ) material interaction produces little thermal damage. Moreover, UV laser beam can be focused into much smaller beam spot than IR or green laser beam. System integrator could integrate the laser system with an automation machine for specific application.

Technology Features & Specifications

A diode-pumped solid-state UV laser system prototype has been developed, with an output power of up to 10 W at 30 kHz. The system is cooled by a thermal electric high flow rate chiller to ensure good stability and reliability output from the laser head. A flexible electronic control was developed, to enable the system to interface with automation systems for a variety of applications. The laser parameters can be changed from the touch screen panel in front of the power supply unit as well as through PC communication. A scan head is integrated with the laser system to offer flexibility in material processing. A user friendly laser marking software is also implemented in the system.

Potential Applications

The system can be used in various applications such as PCB cutting, wafer scribing and sapphire-substrate-based LED scribing, and other potential applications such as cutting on thin-film copper and gold, indium-tin oxide (ITO) removal, patterning on glass, photo ablation of organics and direct marking on most metals and polymers.

Market Trends and Opportunities

This technology will benefit local system integration companies related to semiconductor or photovoltaic. The developed Diode-Pumped Solid State (DPSS) UV laser will have higher conversion efficiency with optimized harmonic generation, and better beam quality compared to current laser system. With good beam quality and short wavelength, the laser beam can be focused to a very small spot size in microns. Novel harmonic generation design solves the lifetime issue of high-power UV laser and provides excellent nonlinear conversion efficiency. The laser output can be further split into multiple beams to improve the processing speed.

Customer Benefits

Current systems are based on extra-cavity harmonic generation technique, which needs to focus the IR and green beams tightly into harmonic crystal. The crystal needs to be indexed to another new position every 200 hours. The system has been designed with intra-cavity harmonic generation of 355 nm laser wavelength which does not require indexing of the nonlinear crystals, hence will not interrupt the production run and affect the laser pointing stability and performance accuracy.

OVERVIEW

- Technology Category Manufacturing - Surface Finishing & Modification
Manufacturing - Subtractive Machining
- Technology Status Available
- Technology Readiness Level [TRL5](#)



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