APPLICATION NOTE: LASERS FOR INDUSTRIAL APPLICATIONS

The applications of 'Diode Pumped Solid State Lasers' (DPSSL) have experienced a rapid development in a large number of activities from industrial, medical, space and defence. These new activities are made possible by development of new performance in "High Power Laser Diodes" (HPLD). Modulight's HPLDs are used for pumping DPSSL. The main applications are material processing, medical therapy, measurement and analysis, printing and imaging, and spectroscopy.

High Power Laser Diodes

Modulight manufacturers high power laser diodes (Fig. 1.) operating in the wavelength range of about 0.78 to 1.1 micron. These lasers are used in optical pumping of solid state lasers, such as the Nd:YAG, replacing traditional flash lamp designs. High-power laser diodes are tuned to the absorption band of the dielectric crystal resulting in much more efficient pumping of the laser rod, from which a high-power focused coherent beam of light is emitted. This beam can then be used in a variety of industrial, medical, and military applications. Laser diodes have been developed to match the absorption bands of a variety of dielectric crystals in a broad wavelength range.

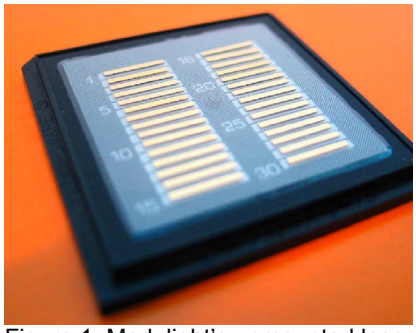

Figure 1. Modulight's unmounted laser bars.

The laser diodes are packaged in individual heatsink assemblies in order to have continuous wave (CW) operation (Fig. 2). These individual heatsinks could be stacked to form a linear array of CW laser diodes.

Figure 2. Example of high-power laser diode package.

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In addition to applications involving the pumping of solid state laser rods, high-power laser diodes are also used for direct processing like marking, welding, and cutting of metals and various other materials. This is possible by stacking several high-power laser diode bars on top of one another to make stacked laser diode arrays with output powers potentially in the range of kilowatts. Typically, direct diode lasers operate at a shorter wavelength than the Nd:YAG (1.06 µm) and CO2 (10.6 µm) lasers, which are commonly used in industrial applications. This leads to an advantage of the diode laser system, since the lower operating wavelength results in a higher absorption rate with most metals. This is especially true for aluminum in which the absorption peak is at the HPDL wavelength of 810nm. In the case of laser heat treating, diode lasers do not require pre-coating of metal parts in order to achieve higher absorption as with the case of CO2 lasers.

Advantages of High Power Laser Diode

The advantages of direct diode lasers are the high wall plug efficiency, order of magnitude smaller footprint, lower maintenance, high absorption in work piece, and high control bandwidth. The HPDL are very small and compact, such that the entire laser head can easily be mounted to the end of the robotic arm or gantry for use.

Another advantage of direct diode lasers is that they are solid-state lasers. This yields a highly controllable heat source. Unlike conventional systems, diode lasers do not require warm up time to stabilize. Power can also be turned on and off instantaneously, which realizes additional energy savings.