Near-infrared Diode Laser Components Keep Applications Secure

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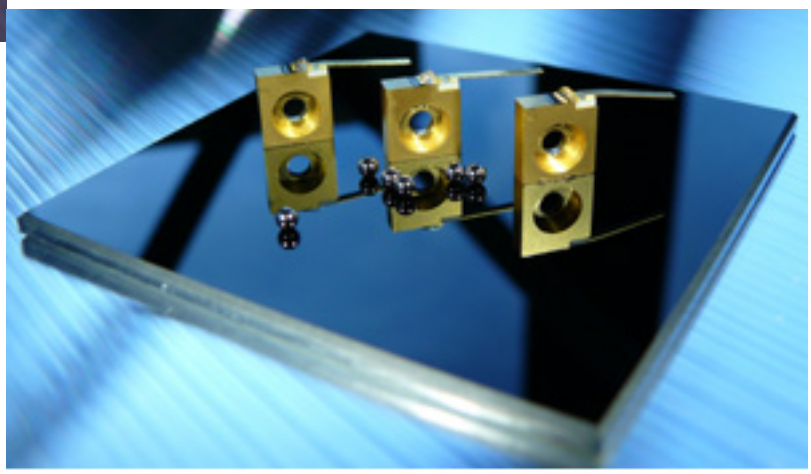

Figure 1. Single stripe diode laser

Nowadays security is the key to whether it is in homeland defence, or security monitoring of parking lots or buildings. Surveillance systems are either passive systems using IR cameras, or active systems based on infra-red light sources, which are invisible for human eye, but detectable by optoelectronic sensors and cameras. Standard infrared diode lasers work outside the visible range (800nm to 980nm) and can be easily detected by standard silicon sensors. Even a normal digital camera or the ones integrated in mobile phones are sensitive in this wavelength range, due to the silicon detectors used inside.

More sophisticated optical means for these applications could be found in the field of high-power diode laser components, especially using near-infrared or short-wave infrared optical emitters in the range of 1550nm up to 1950nm, which are generally not been detected by standard silicon detectors. Of course for such a wavelength range, the use of appropriate detectors is necessary, but one gains the advantage “to see and not being seen,” unless, of course, the counterpart is also using more sophisticated detectors as well. The active approach, illuminating an area and monitoring it with a camera allows better signal to noise ratio and hence better

images, respectively allowing to use un-cooled detectors and still get good images because of the high signal level.

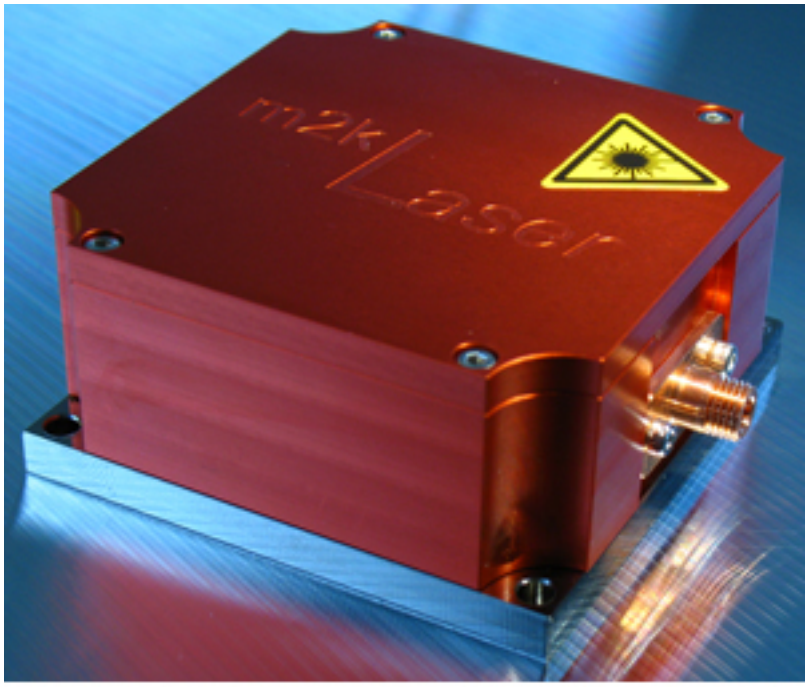

Figure 2. Fiber-coupled single stripe at 1950nm

High-power diode lasers are normally based on diode laser chips or arrays of such chips. These arrays could be as wide as 10mm with 19, 25 or higher number of laser emitters arranged on a single chip. Further increase of power can be achieved by stacking such mounted diode laser arrays vertically.

Conduction-cooled, high-power diode lasers in this wavelength range are now available for continuous operation as a fiber-coupled module, ranging at 1550nm from 6W to 80W CW, and at 1950nm from 500mW to 18W CW, with the possibility to scale-up power by adding more diode lasers into the package. Also available are conduction-cooled stacked products, comprising of a series of stacked laser bars. The use of pulsed diode lasers allows time resolution and therefore distance resolution, as used for range finders or in gated imaging, allowing to detect even through smoky or foggy areas. Pulsed diode lasers such as stacked arrays are available with scalable power level of several 100W peak power e.g.

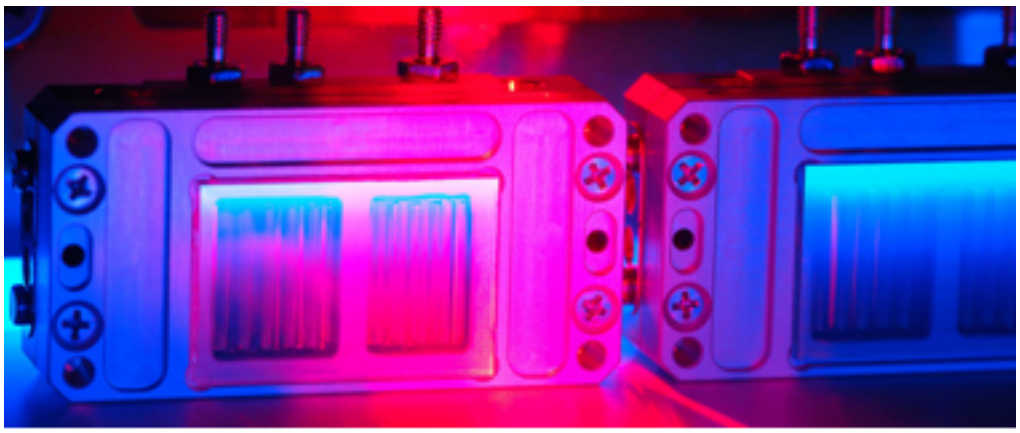

Figure 3. QCW stacked array of high power diode lasers

With active illumination at such power levels, the applications usually are long distance, hence in the field of applications, surveillance can be performed for area and borderline protection up to battlefield illumination, or even in search and rescue.

For continuous operation, driving of such high-power diode laser components does require a voltage between ~1.5 Volts for a single diode laser; up to ~10 Volts for a six bar module; and a current between 5 Amp and 80 Amp, depending on the optical power level. But also pulsed operation is possible with e.g. 500nsec pulses at 50A and 1.1V at 1950nm.

In addition, high-power diode lasers have further potential applications in the field of infrared-countermeasures (IRCM) for air-defence systems, monitoring atmospheric pollution or chemical weapons (1800nm to 2300nm), as well as in laser surgery or material processing, especially the welding of transparent plastics.

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