Commercial application aspects of QUANTUM CASCADE LASERS

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In 2004 LASER COMPONENTS GmbH launched the pocket-sized QUANTA-OEM into the market as a work horse turnkey system for the infrared community. It is optimized for intra pulse spectroscopy but can also be used for general purposes. As a rule of thumb, applications in industrial process control require a lifetime of five years with 24 hours operation. Since no detailed lifetime testing according to telecom standard exists on quantum cascade lasers we simply limited the duty cycle of our electronics. This is a rather pragmatic approach but serious data are needed from the QCL manufacturer community. The sooner the better.

DFB-QCL do show rather low temperature and current tuning rates. Additionally, with many applications one spectral point must be precisely hit. This implies low yield and high pricing, even in volume. The questions to the QCL community are: Can tuning rates be increased? Are concepts for on wafer screening possible in the mid infrared range similar to the HCSEL (horizontal cavity surface emitting laser), which have just been successfully realized for uncooled operation in the near infrared [1]?

Many customers consider the QC laser as an ordinary mid infrared laser that competes with existing lasers like CO$_2$ lasers. Similar to the diode lasers used for material processing close to wavelengths of the Nd:YAG laser it can be expected that a market can be created for pocket-size diode lasers at 10.6 µm. A rough estimate is >10 W of minimum peak power to create this application. In addition, special care must be taken on the far field behaviour in those cases. Very little work has been done here according to our knowledge.

In 2006 we extended the QUANTA-OEM concept into the THz range [2]. As a preliminary compromise the thermoelcetric cooling was replaced by liquid nitrogen cooling. Simple imaging demonstration at video rate (50 Hz) with a SNR of 85 at room temperature detection was performed. The peak power of the laser used was 0.15 mW. There are several sales problems with the THz: Discussion is dominated by femtosecond laser based systems that are offering spatial and spectral resolution. So far room temperature detection in THz is based on thermal or pneumatic detectors. In conclusion, at least a factor of 100 in power improvement is needed (with no compromise on lifetime). Last, but not least, a systematic coverage of the region is needed.

[1] M. Möhrle, A. Sigmund, A. Dounia, L. Mörl, 1300 nm Horizontal Cavity Surface Emitting BH-DFB-Lasers for uncooled operation, accepted for publication in Photonics Technology Letters
http://www.opticsinfobase.org/abstract.cfm?URI=oe-14-5-1829