Application Note #10

Replacing Flash Lamp-pumped Lasers in the Medical Device Industy

Introduction

Fiber lasers have made a serious impact in many laser applications in recent years. High power continuous wave (CW) fiber lasers and low power Q-switched fiber lasers have both dramatically increased their market share with the evolution of fiber laser based products that compete strongly against conventional laser technology.

The medical device industry will benefit greatly from the advancements made in the new long pulse fiber laser that matches the specifications of flash lamp-pumped Nd:YAG lasers for microprocessing tasks. IPG's Quasi Continuous Wave (QCW) Fiber laser, a long-pulse, high-pulse-energy laser, was awarded the 2011 Prism Award for Industrial Lasers, a major industry prize for Innovation in Photonics. These new QCW fiber lasers have been designed specifically to replace inefficient flash lamp YAG pumped lasers; the result is a much smaller, much more efficient laser that requires zero maintenance and has extremely long lasting pump diodes.

Fiber lasers have many overall advantages including scalability, ease of use, better pulse-to-pulse and power stability, zero start up time, lower voltage requirements, air-cooling, and lower cost of ownership; we will discuss the most important to the medical device industry in this application note.

QCW Laser Benefits

Laser welding is a complex multi-variable provess and it is often difficult to identify the indicitual effects of key laser viariables. Additionally, with flash lamp-pumped lasers, the laser spot size usually changes as pump power or energy is increased, hence even more variables are introduced into the provess. with fiber lasers this does not happen, as pump power is increased to increase pulse energy, for example, the laser spot size stays the same as does the focus position. Any increase in the actual spot size produced on the material is simply a result of the different pulse energy being applied.

Substitution for Existing Laser Process

Qualification of a laser process in the medical device industry can be a costly and time consuming process. Because the beam from a QCW Fiber laser can be exactly the same as that from a flash lamp-pumped YAG laser, requalification for FDA approval may not be necessary. in fact, in some cases the laser parameters will be very similar to those used with existing YAG laser.

Long Term Laser Stability

Single emitter diode pump sources ensure that long term output from a fiber laser is far mroe stable than flash lamp-pumped lasers in the medical device insudtry. Fiber lasers have become black boxes and are considered fit and forget devices. in a well set up process, no operator intervention is required, this means that laser specialists are not necessarily required for 24/7 operation. certainly, no flash lamps need changing because there are none.

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Wall-plug Efficiency

Fiber lasers are 10 times more efficient than flash lamp lasers, 30% as compared to 3%, the result is a huge reduction in electrical power usage. Most lamp-pumped YAG lasers require three-phase power and water cooling while fiber lasers below 500 watts can be air-cooled and run on single phase power.

Reduction in Footprint

QCW lasers, housed in a 19" rack mounted unit, 4U high, 110 V and air-cooled, are many times smaller than an equivalent flash lamp laser.
This may represent a huge savings if clean room space is limited.

The QCW's proprietary diodes pump an active fiber at 10 times the average power to produce up to 15 J from a 150 W fiber laser with pulse lengths ranging from 0.2-10 ms and peak power up to 1500 W. An almost Gaussian beam with an M^2 of <1.1 from the single-mode active fiber means that the brightness is well in excess of anything else available in this format. Optional 50, 100 or 200 µm delivery fibers and a range of collimator focal lengths mean that an enormous range of spot sizes are available at the workpiece to handle a variety of applications. In addition, the laser can be run continuous wave at 250 W average power which may reduce cycle times.

QCW Applications

IPG's Application labs have proven that the QCW lasers can match the performance of flash lamp-pumped YAG lasers in any application and outperform them in most. The cutting and welding applications shown in figure 1 below are typical of those that are ideally suited for IPG's QCW fiber lasers.

Summary

An entirely new type of pulsed fiber laser is now available from IPG Photonics. As discussed in this overview, the QCW fiber laser provides numerous advantages over conventional flash lamp and diode pumped Nd:YAG lasers and the existing YAG laser can be replaced with the QCW laser in only a matter of days.

IPG looks forward to helping our customers with their laser applications. Contact any of IPG's application facilities to arrange free sample evaluation & process development.
Go to www.ipgphotonics.com for more information on all of IPG's products.

Figure 1: Cutting and Welding Applications

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