New lasers drive powerful applications

August 12 2009

(PhysOrg.com) -- Telecoms, healthcare and display technology will be the major beneficiaries of a new generation of semiconductor lasers developed in a massive European research effort. Better cancer treatment, wider bandwidth and smaller, better displays could be on their way.

The Brighter project, which is co-funded by the European Union, has set a series of world firsts in lab-based records for semiconductor lasers in the red, infrared and green spectra. These results will not languish on the testing bench. The Brighter project began its work with three, hugely important applications already in its sights.

One of the most compelling is a new type of cancer treatment and imaging enabled by semiconductor lasers developed by Brighter. Photodynamic therapy is a very promising treatment for cancer patients that can maximise the benefits, while minimising the harm, from chemotherapy.

Photodynamic therapy works by introducing an inactive chemotherapy drug into the patient. This drug then seeks out and attaches itself to cancer cells. The drug is then activated by laser. It is a very promising and potentially highly effective treatment that only releases drugs at cancer cell sites, reducing the side effects and enhancing the impact on tumours.

Clinical studies

In Brighter, the scientists developed a range of lasers for different elements of the treatment. Powerful and highly reliable red lasers - one at 635nm another at 650nm - were developed to activate different drugs. Meanwhile, a high-powered blue laser provides fluorescent spectroscopy, to show that the drug has reached the target site. Finally, a high-powered ultraviolet laser provides auto-fluorescent imaging of the cancer site.

Both clinical and experimental animal studies are currently underway for different elements of the treatment, and any promising results are likely to be commercialised. “We have end users, medical doctors, working within the project to ensure that the technologies developed are best suited to their needs,” explains Michel Krakowski, coordinator of the Brighter project.

Telecommunications, too, is a compelling application and Brighter has developed a range of elements to respond to pressing needs in the sector.

“We have developed a range of lasers and their associated technology to considerably boost bandwidth across optical fibres for data-intensive telecoms,” explains Krakowski. The upshot is more bandwidth in the same pipe, an application that will go a long way to meeting the challenge of rising demand for bandwidth.

This was a non-trivial problem. In addition to developing a semiconductor of the required quality and power, the Brighter project had to develop methods for coupling lasers together, to create an even more powerful light source, and then coupling the light to optical fibres.

New products

In displays, Brighter hopes to usher in new products or better, smaller and more efficient versions of existing products. Current applications in

sight are extremely small, powerful and efficient light projectors for film, presentations and other applications, such as heads-up-displays and mobile projectors.

The technology could even be adapted for use with mobile phones, allowing them to project extremely high quality video for television applications, for example. In the coming months, the high-performance red and green laser modules developed in the Brighter project will be tested for feasibility for display applications.

For all these applications, Brighter has developed and perfected a vast range of fabrication and design techniques for semiconductor lasers, including doping, deposition, and external cavities on the semiconductor material to “tune” the laser, stabilise it, or couple it with other lasers, depending on the required results.

Beyond theory and applications

Brighter’s work did not stop at theory or application, either. The team engaged in a surprisingly large-scale effort to disseminate new knowledge gained on laser production, characterisation, design and fabrication.

These educational materials cover a vast range of the latest thinking on lasers and present them in a series of tutorials and presentations on the project and its work. The aim here is to make effective materials available for students and others, and to expand the pool of expertise in this field in Europe and around the world. Brighter’s online materials and CD-ROMs are freely available to anyone.

There are 46 PhD students involved - 21 directly funded through Brighter with a further 25 contributing to and/or benefiting from the project, notes Krakowski. “We made a special effort with dissemination

because we wanted to spread the impact of our work and raise the profile of the field."

The EU-funded project is now expected to end in January 2010, by which time it plans to have fully demonstrated Europe's expertise in semiconductor laser technology, and its ability to create compelling new devices over the next two to five years.

The Brighter integrated project has received funding from the ICT strand of the EU's Sixth Framework Programme for research.

This is the second of a two-part special feature on Brighter published on ICT Results.

Provided by ICT Results