ISLA project newsletter #4

November 2013

ISLA is a project supported by the European Commission under the Seventh Framework Programme (FP7).

Welcome to the fourth ISLA project newsletter!

The project has been running for two years now, and the progress has been encouraging. In this newsletter we report on pump diode development at II-VI Laser Enterprise (formerly Oclaro Switzerland) and modelockers based on graphene which are being investigated at Trinity College Dublin. ISLA has also been active at several conferences recently, including the Workshop on Speciality Optical Fibres (WSOF 2013; see below) and the major EC event held in Vilnius, "ICT 2013 Create, Connect, Grow."

The ISLA Advisory Group (IAG) has continued to grow, and some important connections have been made with commercial and academic organisations interested in 2 µm fibre laser technology. Readers wishing to know more about the project are invited to join the IAG, which offers an opportunity to help direct the development work and to identify and develop new applications for 2 µm fibre lasers with the consortium.

Andrew Robertson (G&H) also runs the 2um and mid-IR lasers group on LinkedIn: new members welcome!

ISLA at WSOF 2013

3rd Workshop on Specialty Optical Fibers & their Applications

28-30 Aug-2013; Sigtuna, Sweden

This meeting, hosted by Acreo, was a highly successful workshop on advances and innovations in the field of specialty optical fibres including key ISLA topics. Just like the two previous workshops in the series, it brought together students and researchers from academia and industry, with an interest in fibre optics. Social events included canoeing for the adventurous, which certainly brought out the competitive nature of the industry!

A photo of the beautiful harbour at Sigtuna
[Image from http://destinationsigtuna.se]

Consortium

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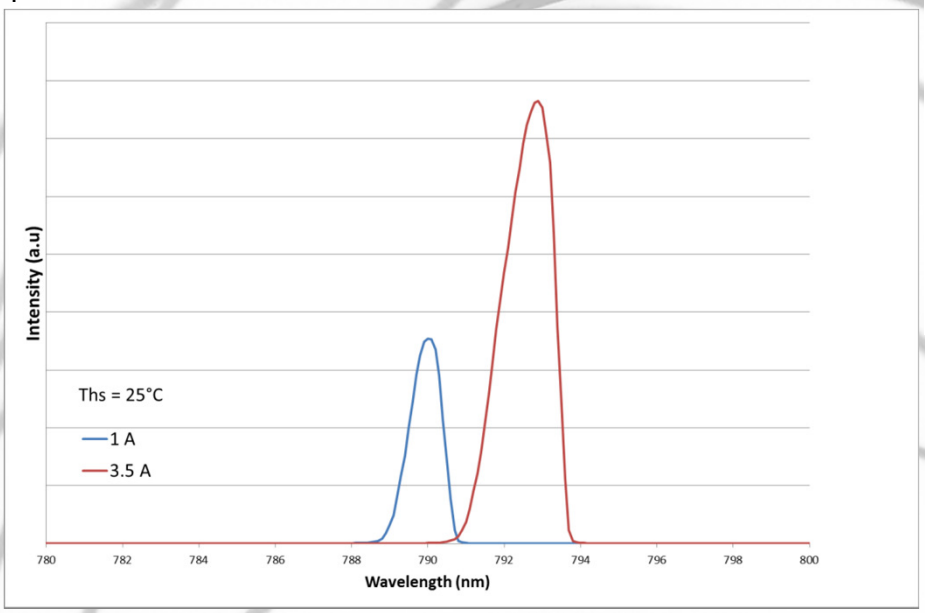
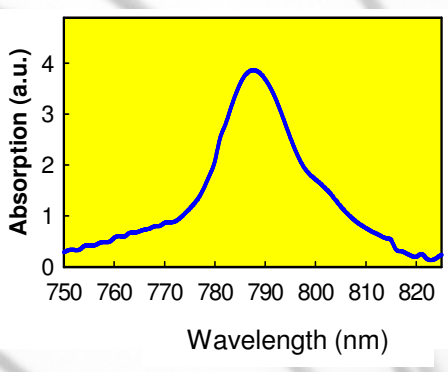
79x nm pump diode development

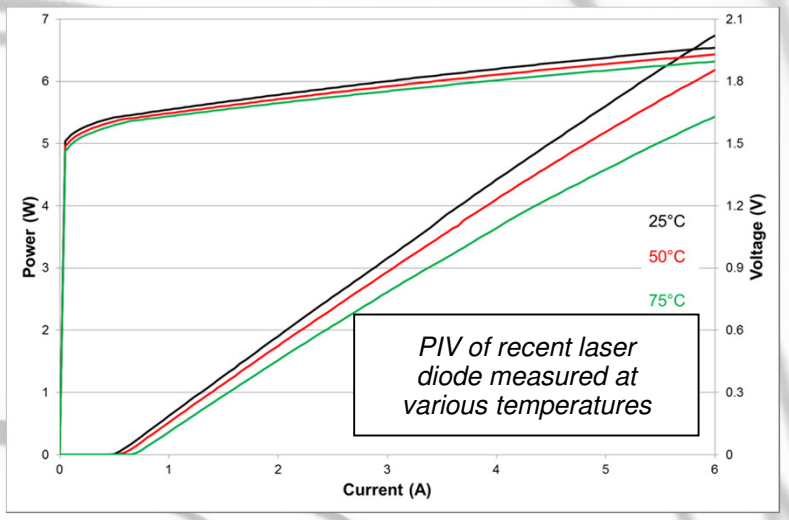
Within the ISLA project, II-VI Laser Enterprise (formally Oclaro Switzerland) has developed pump laser diodes at 79x nm that are optimized for pumping thulium (Tm) doped double-clad fibres, as can be seen from the absorption spectra opposite. With the current design the laser diode, with a 90 µm wide stripe, has a slope efficiency of 1.29 W/A at 25°C. The output power at 6 A injection current exceeds 6.7 W with a wall-plug efficiency of 57% even at this high power level.





Above: Graph showing the absorption spectrum of Tm:Si [Courtesy of Southampton ORC]

Left: Emission spectra of laser diodes at 25°C heat sink temperature and different operating currents.



Typically the centre wavelength of laser diode shifts with temperature by roughly dλ/dT ~0.3 nm/K. For pumping materials with narrow absorption bands and a wide operation regime, wavelength stabilization is required. The most cost efficient approach is the introduction of distributed feedback by internal longitudinal gratings (DFB laser). For the 79x nm wavelength range the choice of the right grating material is critical. Main requirements are a wide band-gap to reduce optical losses at the lasing wavelength and good (defect-free) material quality after overgrowth. Standard materials like GaAs have a strong absorption at 79x nm. This disadvantage could be overcome by the use of AlGaAs gratings, but strong oxidation of the AlGaAs leads to poor material quality after overgrowth. Within the ISLA project a grating material with low optical losses and good material quality after overgrowth has been developed.

Detailed results including fibre-coupled results implementing the devices in a 105 µm 0.15 NA multi-emitter platform will be shown at Photonics West 2014 (Paper 8965-26).

For more info contact Susanne Pawlik: spawlik@laserenterprise.com

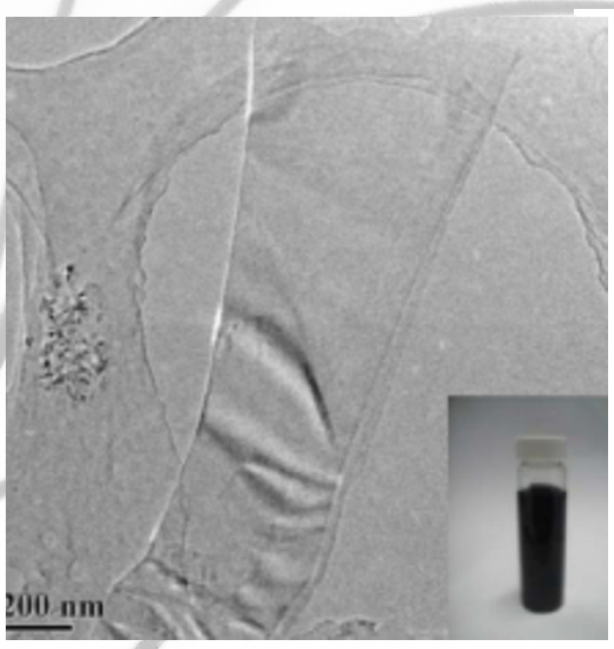
Graphene modelocking

A saturable absorber (SA) is an optical device that exhibits an intensity-dependent transmission. This characteristic is used in passive mode-locked lasers; the SA will selectively absorb low intensity pulses, but transmits sufficiently high intensity pulses, resulting in the generation of a train of ultra-short laser pulses.

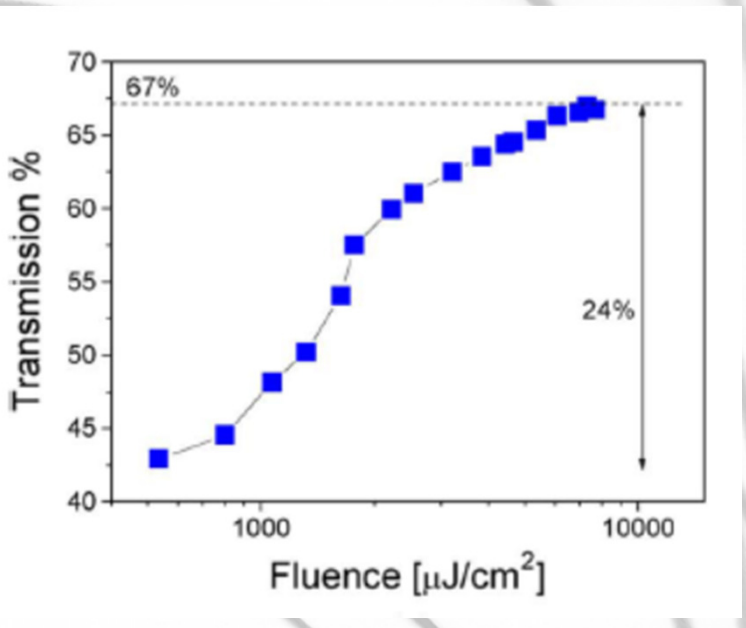
Graphene exhibits linear absorption which is almost wavelength independent from the visible region through to the far infrared, whilst absorbing a significant amount (2.3%) of light per single layer. With a finite number of carriers in the monolayer, Pauli blocking enables graphene to exhibit optical-saturable absorption. Graphene can be saturated over the visible to near infrared region and it has a smaller non-saturable loss and higher damage threshold, compared with carbon nanotubes.

For initial experiments in ISLA, dispersions of graphene were prepared in a standard solvent, di-methyl-formamide (DMF), at an initial concentration of 5.0 mg/ml. These dispersions were stable against sedimentation and displayed no further aggregation for a period of weeks. The graphene was transferred onto the end face of an optical fibre pigtail using optically-driven deposition from a single-mode laser diode at 976 nm. The complete SA unit is produced by joining this graphene-coated fibre pigtail and a clean fibre pigtail with a mating sleeve.

The non-linear optical absorption of the graphene-based SA was investigated with a mode-locked fibre laser at 1053 nm as a probe. The saturation fluence was determined to be 1300 μJ/cm^2, where the saturable loss reduced by 37%.



Transmission electron microscopy image of a graphene flake together with a picture of the initial dispersion.



Graph showing transmission of the graphene-based saturable absorber unit versus launched fluence of a short pulse laser at 1053 nm.

For more info contact Prof. Werner Blau (Trinity College Dublin)
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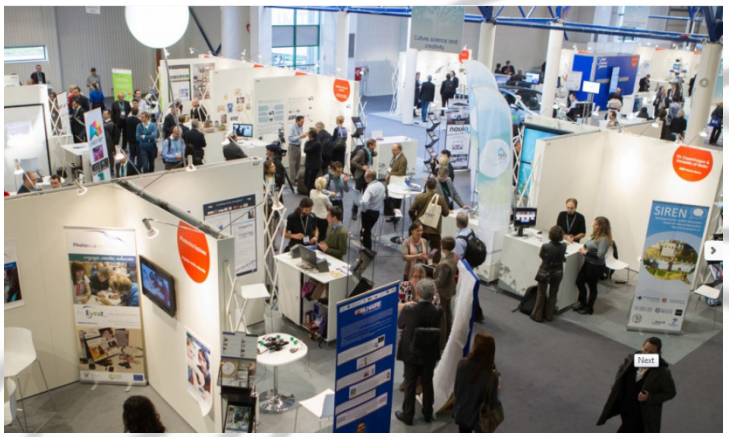


Images of the exhibition and opening conference of ICT 2013. [Images from the website of the Lithuanian Presidency of the Council of the EU 2013 (www.eu2013.lt)

ISLA at ICT2013

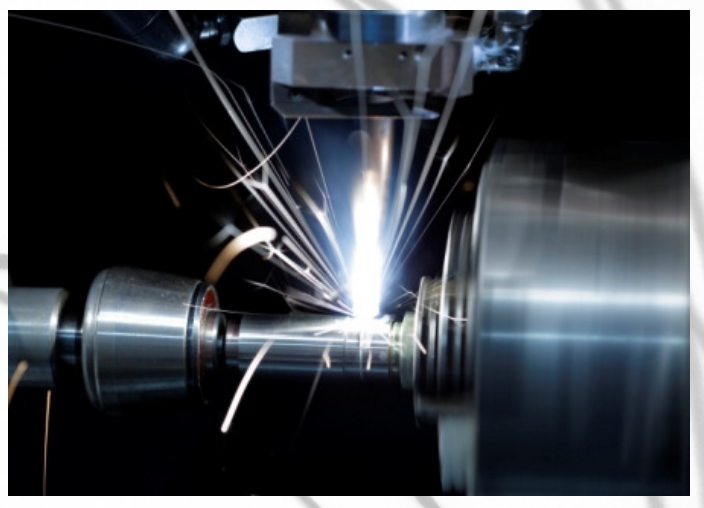
There were almost 5000 attendees and 200 exhibition booths at this major ICT event in Vilnius, Lithuania (06-08 Nov-2013). ISLA had a booth and there was considerable interest in the project. The exhibits covered a wide set of research results and products, ranging from cars and advanced robots to software and healthcare.

Photonics is funded through this part of FP7, and this will continue under Horizon 2020. At the conference, there were presentations from the EC on expected topics for H2020 in photonics, as well as other areas of ICT.

ISLA Advisory Group

The consortium seeks to build relations with all organisations with an interest in 2 µm fibre lasers. In particular we would like to discuss ISLA with end users and we hope to find novel applications which could take advantage of 2 µm radiation. To date we have over fifty members of the IAG from a wide range of backgrounds:

- Component manufacturers
- Laser/ system integrators
- Academia
- Research organisations
- End users.



Join the IAG!

If you would like to find out more and be involved with the project please contact Bruce Napier bruce@vividcomponents.co.uk