SU2P *[ěs ū tōō pē]: an innovative bridging project connecting Scottish and Stanford Universities; an industry-academic interaction; entrepreneurial activity in photonics*

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Title: Intra-Cavity Optical Parametric Oscillator based upon OP-GaAs.

Introduction

This SU2P project involved a collaboration between the Nonlinear Optics Group in the University of St Andrews, Stanford University, and M Squared Lasers Ltd. Personnel involved included Professors Martin Fejer and Bob Byer at Stanford, Professor Malcolm Dunn and Dr David Stothard at St Andrews, and Dr Graeme Malcolm at M Squared Lasers. The particular aim of the project was to extend the spectral coverage of intra-cavity optical parametric oscillators, pioneered in St Andrews, deeper into the infrared by using a new nonlinear optical material, OP-GaAs, pioneered by Stanford.

Project

During this programme, two samples of OP-GaAs were supplied for evaluation in the context of an intracavity optical parametric oscillator (OPO). The provenance of these crystals was the US Air Force Research Laboratory (AFRL) and BAe Systems in the US, and they were supplied via DSTL. We constructed a 2µm pump laser in which to evaluate the samples based upon a Th:YAP (Th:YAlO) laser crystal pumped by a 20W, 795nm laser diode. In the limited time available to us, we evaluated the 60.5µm poling period OP-GaAs crystal, supplied by BAe / DSTL, in the context of an intra-cavity OPO pumped internal to a Th:YAP laser. At a diode pump power of 15W and in the pulsed regime (150kHz repetition rate), 90mW of idler (at 6.5µm) was extracted and this corresponds to a total down-converted power of 600mW. To our knowledge, this is the first demonstration of the use of this nonlinear material in an intra-cavity OPO. We are optimistic that current performance can be improved.

Benefit

This baseline funding provided leverage to raise substantial complementary funding both in kind (for example personnel support from the SUPA KT Initiative), as well as through follow-on related projects (EPSRC, CDE/DSTL, M Squared Lasers Ltd; to a total value of £160K). In addition, it led to further collaborations being fostered in particular with: the Institute of Photonics at Strathclyde; the US AFRL (through DSTL), a vital link for the provision of high-quality OP-GaAs; and currently with the new Fraunhofer Centre for Applied Photonics in Glasgow. We anticipate that two journal papers will be submitted in the near future reporting on both the pulsed and continuous- wave aspects of this work.

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