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15th International Conference on Mid-Infrared Optoelectronic Materials and Devices (MIOMD)

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15TH INTERNATIONAL CONFERENCE ON MID-INFRARED OPTOELECTRONIC MATERIALS AND DEVICES (MIOMD)

Online event

The Mid-Infrared Optoelectronic Materials and Devices (MIOMD) conference was established in 1996 and organised by Professor Tony Krier at Lancaster University. The conference has since become an established international conference series focusing on the latest developments in the field.

Key dates

- Original abstract submission deadline: Thursday 10 June 2021
- Extended abstract submission deadline: Monday 21 June 2021
- Abstract acceptance notifications: Wednesday 30 June 2021
- Registration deadline: Tuesday 31 August 2021
- Conference dates: Wednesday 1 September - Friday 3 September 2021.

About the conference

The conference is currently held approximately every two years. The **previous conference** was held in Flagstaff, Arizona in 2018.

The 15th MIOMD conference was scheduled to be held at the University of Surrey in September 2020. However, owing to the COVID-19 pandemic this was postponed to 2021 and will now be held as an online meeting from 1-3 September 2021.

A wide range of topics including the following will be covered:

- Infrared optoelectronic materials development, growth, and characterisation
- Infrared optoelectronic devices, components, and systems
- Infrared emitters and detectors
- Interband and intersubband materials and devices
- Novel architectures based on new materials and low-dimensional structures

15th INTERNATIONAL CONFERENCE ON MID-INFRARED: OPTOELECTRONIC MATERIALS AND DEVICES (MIOMD)

Conference Programme

*** All live sessions are on British Summer Time (GMT+01:00) ***

Wednesday 1st September 2021

Topic	Time/ID	Speaker	Organisation	Title
Conference Opening (Live)	**OPENING** **14:00-14:15**	**Stephen Sweeney**	**University of Surrey**	**Welcome Address**
Plenary 1 (Live)	**PL-1** **14:15-15:15**	**Gunther Roelkens**	**IMEC, University of Gent**	**III-V/Si photonic integrated circuits and their applications in spectroscopy**
Scientific Advisory Committee Meeting	***SAC*** ***15:15-16:15***			***Closed meeting for the MIOMD Scientific Advisory Committee***

Session 1: **QCL and ICL Devices** **(Pre-recorded Session)**	**I1-1**	**Roland Teissier**	**University of Montpellier, France**	**Long wavelength mid-IR QCLs: state of the art, physics and applications**
	O1-2	Igor Vurgaftman	Naval Research Laboratory	Toward Robust and Practical Interband Cascade Laser Frequency Combs
	O1-3	Yuzhe Lin	Institute of Semiconductors, Chinese Academy of Sciences	Development of InAs-based Interband Cascade Lasers
	O1-4	Jeremy Massengale	University of Oklahoma	Long wavelength interband cascade lasers with reduced thresholds
	O1-5	Pierre Didier	Telecom Paris - Institut polytechnique de Paris	Analysis and simulation of the relative intensity noise in a Fabry-Perot interband cascade laser highlights relaxation oscillations around GHz
	O1-6	Weicheng You	The Ohio State University	Comparison of BCl3/Ar and CH4/Ar Plasma Chemistries for Dry Etching of Interband Cascade Lasers

Session 2: Photodetectors 1 **(Pre-recorded Session)**	**I2-1**	**Francois Julien**	**University Paris-Saclay**	**Quantum cascade detectors based on wide band-gap semiconductor**
	O2-2	Georg Marschick	Technische Universität Wien	A novel quantum cascade detector (QCD) for low attenuation free-space telecommunication around 9 µm wavelength
	O2-3	Dhafer Alshahrani	Cardiff University	Optical and Electrical Performance of a 5 µm InAs/GaSb Type-II Superlattice Photodiode for NOx Gas Detection
	O2-4	Laura Hanks	Lancaster University	Development of Quasi-Planar In0.14Ga0.86As0.10Sb0.90 pBn Devices for Spectroscopic Sensing
	O2-5	Rui Yang	University of Oklahoma	Fundamental Limit of Detectivity of Infrared Photodetectors

Session 3: **Si Photonics and integration 1** **(Pre-recorded Session)**	**I3-1**	**Milos Nedeljkovic**	**University of Southampton**	**Silicon photonic photodetectors, sensors, and spectrometers for the mid-infrared**
	O3-2	Chen Wei	University of Southampton	Mid-infrared SOI waveguide thermo-optic Fourier Transform spectrometer
	O3-3	Martino De Carlo	Photonics Research Group	Proposal of a semi-integrated QEPAS sensor
	O3-4	Yanli Qi	University of Southampton	Silicon waveguides integrated with switch for low noise mid-infrared sensor

Session 4: **Mid-IR Spectroscopy** **(Pre-recorded Session)**	**I4-1**	**Stefan Hugger**	**Fraunhofer Institute for Applied Solid State Physics**	**MOEMS external cavity QCLs for spectroscopic sensing**
	O4-2	Melissa Najem	Institut of Electronic and Systems, University of Montpellier, France.	Multimodal infrared vibrational spectroscopy from 1.1 to 6.5 microns using MIM Aluminum Bowties
	O4-3	Diba Ayache	University of Montpellier	Infrared spectroscopy for exhaled breath diagnosis
	O4-4	Pierre Fehlen	NS3E-ISL, l'Université de Strasbourg & IES, Université de Montpellier	Surface-enhanced infrared spectroscopy for selective and sensitive detection of organophosphorus compounds
	I4-5	**Jana Jagerska**	**University of Tromso**	**Nanophotonic waveguides with high field confinement in air for on-chip trace gas sensing**

A novel quantum cascade detector (QCD) for low attenuation free-space telecommunication around 9 µm wavelength

G. Marschick[1], M. David[1], A. Delga[2], N. Opacak[1], B. Schwarz[1], M. Lagree[2], T. Poletti[2], A. Evirgen[2], B. Gerard[2], G. Strasser[1], B. Hinkov[1]

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Traditional telecommunication in the near-IR spectral range is a suitable tool for fibre-based long-range data transmission. However, it reaches in free-space geometries its performance limitations in terms of bandwidth and transmission, especially in turbulent atmospheric conditions. This is where mid-IR quantum cascade (QC) based systems show significant advantages. The available long-wavelength region between 8 – 12 µm is of high relevance due to its low water vapor absorptions, while sensitivity to turbulences and scattering by aerosols and droplets are very low. Moreover, QC lasers (QCLs) offer additional beneficial properties like e.g., intrinsically high, i.e. up to GHz frequencies, direct modulation characteristics [1].

In this work we present a novel InGaAs/InAlAs/InP QCD operating at around 9 µm wavelength. It is a crucial building-block for a (monolithic) integrated heterodyne detection system. Detector ridges with different lengths (100 µm - 1200 µm) and a uniform ridge width of 14 µm were processed. We performed first spectral response measurements between 8 µm and 11 µm comparing a 15-period with a single period [2] design using a commercial external cavity QCL. The 15-period design QCDs result in a higher bandwidth (independent of their ridge length) as compared to the single period detectors. The bandwidth of the single period devices increases with device length (Fig. 1). We extract peak responsivities of up to 0.82 A/W and 0.34 A/W for the 15-period and the single period structure, respectively, when using the active region plus the low doped ($n_d<10^{17}$) layers of the cladding and the 14 µm ridge width as facet for in-coupling of the light. As the significantly different active region area (optically active part) was not yet included in the calculations (the responsivities are compared for similar facet areas instead), a higher responsivity for the single-period detectors is expected in a refined analysis and in agreement to literature. [2]

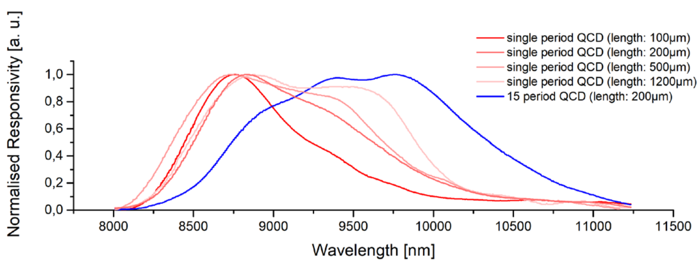

Fig. 1 - Normalised spectral response of multiple single period devices of different length compared to a typical 15-period device.

References

[1] B. Hinkov, A. Hugi, M. Beck, and J. Faist, "Rf-modulation of mid-infrared distributed feedback quantum cascade lasers", Opt. Express 24(4), 3294 (2016).

[2] Schwarz, Benedikt, et al. "The limit of quantum cascade detectors: A single period device." *Appl. Phys. Lett.* 111.6 (2017): 061107.