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

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

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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

LWIR dielectric-loaded surface-plasmon-polariton waveguide for optical sensing

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Waveguides are a crucial building block for on-chip optics and mid-IR sensors. Plasmonic waveguides, in particular, can offer various advantages including sub-wavelength mode confinement and their suitability as highly sensitive molecular sensing platforms. In recent years there has been a surge of research aiming to identify new plasmonic media for the mid-to long-wave infrared spectral range [1, 2], mainly designed for silicon photonics and therefore CMOS-compatible integration. When addressing III-V monolithic integration for quantum cascade laser and detector (QCLD)-based lab-on-chip sensors [3], the integration of these novel plasmonic materials is often challenging. To prevent such technological limitations and to focus on the new materials and configurations, we investigated our novel plasmonic waveguides in a configuration with an external laser and detector first. In this work, we focus on the combination of patterned Germanium-Gold ridge-type cavities on silicon substrate for plasmonic waveguiding in the long-wave infrared (LWIR) region of ~6-12 µm. After conducting numerical simulations (commercial software “COMSOL”), the 9 µm wide and 1-2 mm long ridge-waveguides were fabricated in our state-of-the art in-house cleanroom, and their transmission was measured experimentally with a homemade waveguide setup, comprised of a tunable external cavity QCL (“Daylight Solutions”) in- and outcoupling optics to the plasmonic waveguide and a MCT detector. . The total waveguide losses are measured to be as low as 10.2 dB/mm at 9.5 µm wavelength and remain <20 dB/mm for the entire spectral range between 6–12 µm. Details on the waveguides are shown in Fig. 1. This demonstrates the design and realization of highly broadband LWIR dielectric-loaded plasmonic waveguides, which, due to the guiding of >> 90% of the mode outside in the surrounding medium, are highly suitable for sensitive on-chip species detection in liquids and even gases. With this we pave the way for a wide range of on-chip optics and spectroscopic applications using such novel LWIR integrated systems.

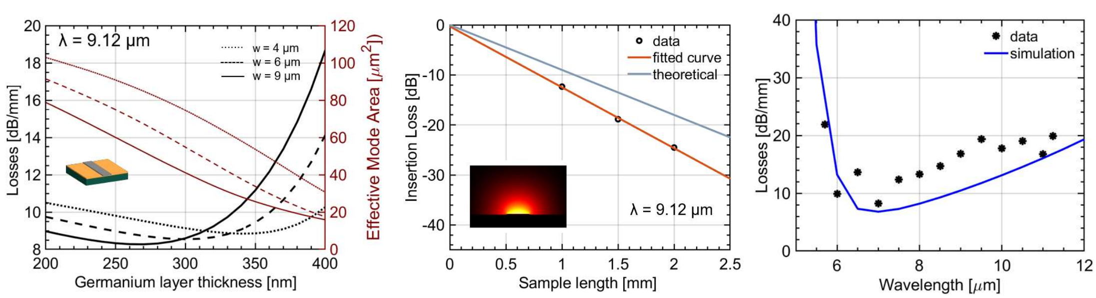

Figure 1. (Left) Simulations of the waveguide losses and effective mode area for different Ge-thicknesses and widths. (Center) Measurements of the waveguide losses for 9 µm wide ridges and different waveguide lengths. (Inset: simulation of the optical mode profile). (Right) Measurements of the spectral bandwidth of the waveguides are represented by the total losses after propagating through the plasmonic waveguides.

References

[1] Taliercio, T. et al., “*Semiconductor Infrared Plasmonics,*” Nanophotonics, 2019.

[2] West, P.R. et al., “*Searching for Better Plasmonic Materials,*” Laser & Photonics Reviews, 2010.

[3] Schwarz, B. et al., “*Monolithically Integrated Mid-Infrared Lab-on-a-Chip Using Plasmonics and Quantum Cascade Structures,*” Nature Communications, 2014.

Friday 3rd September 2021

Topic	Time/ID	Speaker	Organisation	Title
Session 9: **Si Photonics and integration 3** **(Pre-recorded Session)**	**I9-1**	**Mircea Guina**	**Tampere University**	**Broadband light sources at 2-3 µm region based on GaSb/SOI hybrid integration**
	O9-2	Lauren Reid	University of Southampton	PIN-ch me!: A Ge-on-SOI photodiode with response up to 3.8 µm
	O9-3	Colin Mitchell	University of Southampton	Development of Hybrid Integration of Quantum Cascade Lasers with Germanium Waveguides for Mid-IR
	O9-4	Michele Paparella	University of Montpellier - Polytechnic University of Bari	Analysis of the optical coupling between monolithically integrated GaSb laser diodes and SiNx waveguides
	O9-5	Wei Cao	University of Southampton	MIR Silicon Modulators in the 2 µm wavelength band

Session 10: Communications and sensing **(Pre-recorded Session)**	**I10-1**	**Natalie Wheeler**	**University of Southampton**	**Hollow core optical fibres for mid-infrared beam delivery and applications**
	O10-2	Olivier Spitz	Télécom Paris	Application of chaos synchronization in injected mid-infrared quantum cascade lasers for private free-space communication
	O10-3	Wioletta Trzpil	IES, Univ. Montpellier, CNRS, F-34000 Montpellier, France	Silicon micro-electromechanical resonator for enhanced photoacoustic gas detection
	O10-4	Florian Pilat	Institute of Solid State Electronics, TU Wien	Spectrally-Resolved Measurement of the Linewidth Enhancement Factor
	O10-5	Jordan Fordyce	Université de Montpellier	Single mode interband cascade lasers for petrochemical process monitoring

Session 11: Plasmonics and nanomaterials **(Pre-recorded Session)**	**I11-1**	**Sergey Morozov**	**IPM RAS**	**Mid-IR Stimulated Emission in HgCdTe QW Heterostructures with Dielectric and "Phonon" Waveguides**
	O11-2	Dao Thang	Silicon Austria Labs GmbH	Resonant Metasurface Absorbers for Infrared Spectroscopic Sensing
	O11-3	Mauro David	Institute of Solid State Electronics, TU Wien	LWIR dielectric-loaded surface-plasmon-polariton waveguide for optical sensing
	O11-4	Loren Patricia	University of Montpellier	Perfect Absorbers based on high doped III-V semiconductor for the next generation of