Mid-infrared silicon photonics for sensing and communications

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Mid-infrared (MIR) silicon photonics has seen rapid development in recent years amidst interest in developing integrated photonic systems that could be used for applications in sensing and communications. In particular there is a focus on mid-infrared absorption spectroscopy, since many gases, chemicals, and biological molecules exhibit strong and unique absorption features in this part of the electromagnetic spectrum (approximately 2-16 μm). Silicon photonics is offering an opportunity to create fully integrated MIR sensing systems on silicon chips, which can benefit from existing silicon manufacturing infrastructure so that sensor chips can be fabricated at low cost in high volumes.

To achieve this low loss waveguide platforms must be developed that span the MIR, and passive components, light sources, modulators, and photodetectors must be developed. This talk will present our group's work on developing new waveguides (e.g. suspended silicon [1], germanium-on-silicon, suspended germanium [2]), modulators, and detectors [3–5] for wavelengths between 2 μm and 8 μm, and will show some preliminary waveguide based sensing experiments.

A second topic of interest for mid-infrared photonics is the development of transceivers for the 2 μm wavelength band, which is being investigated to open up a new communications window that may be needed to alleviate the forthcoming "capacity crunch" in fibre communications. Our work on developing 20 Gbit/s silicon modulators for the 2 μm wavelength [6] will also be discussed.

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