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Widely tunable mid-infrared external cavity lasers

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Abstract

Laser absorption spectroscopy, particularly in the mid infrared range, is a powerful and versatile technique for real time detection of environmental gas species with ppm or higher sensitivity. External cavity lasers (ECL) are commercially available, and are popular for their wide spectroscopic coverage. However, achieving wider tuning ranges through external cavity lasing requires careful design, and an understanding of device and system parameters. A lasing system in Littrow configuration with a tuning range of 100 nm at 2340 nm was developed and analyzed. Temperature insensitive, drive-current stable, single mode tunable lasing was observed in regions close to the gain peak of the gain chip. Traces of Fabry-Pérot (FP) spontaneous emission from the gain chip were observed for lasing wavelengths in the shoulder regions of the gain profile. The FP emission modes in these cases were observed to get stronger at the expense of the single mode ECL lasing at higher drive currents. Complete suppression of single mode lasing was observed for drive currents above 200 mA. Optical alignment and the strength of diffractive feedback of light from the external cavity were found to play key roles in sustaining the ECL emission. The talk will cover the role of semiconductor internal cavity dimensions and material parameters, effects of facet reflectivity and grating dispersive efficiency, and also the influence of laser drive current on the dynamics of single mode ECL lasing and the multimode FP emission. Factors limiting the effective range of wavelength tuning in an external cavity system will be addressed.

Biography

Mohammad Quamrul Huda received his BSc and MSc in EEE from Bangladesh University of Engineering and Technology (BUET) in 1991 and 1993, respectively. He obtained his PhD from the University of Manchester Institute of Science and Technology, United Kingdom in 1997. He joined BUET in 1991, and served as a professor until 2009. He also worked in Nanoelectronics Research Institute, Japan as a Japan Society for the Promotion of Science (JSPS) fellow. Presently, he is working as a visiting researcher at University of Alberta, Canada. He has research interests in lasers, MEMS, and nanoelectronics. He has published over 75 research papers.