Dan Botez et al., J Phys Chem Biophys 2015, 5:4
http://dx.doi.org/10.4172/2161-0398.C1.013

OMICS International
conferenceseries.com

3rd International Conference and Exhibition on
Lasers, Optics & Photonics
September 01-03, 2015 Valencia, Spain

High-index-contrast photonic-crystal quantum cascade lasers: Watt-range coherent mid-infrared power sources

Dan Botez[1], J D Kirch[1], C-C Chang[1], C Boyle[1], L J Mawst[1], D Lindberg III[2] and T Earles[2]
[1]University of Wisconsin, USA
[2]Intraband, LLC, USA

Resonant leaky-wave coupling of antiguides has been used for phase-locking near-infrared (IR) lasers to high pulsed (10 W) and CW (1.6 W) near diffraction-limited (D.L.) powers. The structures are analogous to 2nd-order lateral distributed-feedback (DFB) structures; thus, they represent high-index-contrast (HC) ($\Delta n \approx 0.10$) photonic-crystal (PC) structures that allow global coupling between array elements in an in-phase mode of uniform intensity profile. For mid-IR QCLs coherence over large apertures has been reported from PCDFB lasers and master-oscillator power-amplifier (MOPA) structures. PCDFBs involve diffraction gratings; thus, inherently have low index contrast ($\Delta n \sim 0.008$) and have shown near-D.L. operation to only 0.5 W/facet pulsed power. Flared MOPAs, have shown near-D.L operation to 3.9 W, but have no index steps; thus, are vulnerable to thermal lensing in quasi-CW or CW operation. We have implemented resonant leaky-wave coupling in 8.4 μm-emitting arrays of QCLs. Preliminary results are 5.5 W near-D.L. peak powers. Such HC-PC structures hold potential for >5 W quasi-CW coherent power in the 8-10 μm wavelength range, and >5 W CW coherent power in the 4.5-5.5 μm wavelength range. Furthermore, in combination with single-lobe-emitting, 2nd-order metal/semiconductor gratings, such arrays hold potential for >15 W CW surface-emitted, coherent power from 2-D HC-PC mid-IR QCLs.

Biography

Dan Botez is Philip Dunham Reed Professor at the University of Wisconsin-Madison. He received his PhD from University of California, Berkeley. He is co-inventor of the resonant-optical-waveguide array concept which represents the first photonic-crystal laser structure for spatial-mode control. His recent work focused on mid-infrared quantum cascade lasers (QCLs), which led to the first model for carrier leakage in QCLs. He is a Fellow member of the IEEE and OSA, and recipient of the 2010 OSA Nick Holonyak Jr. Award. He has authored or co-authored more than 400 technical publications of which over 300 were refereed, and holds 52 patents.

botez@engr.wisc.edu

Notes: