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Mid-IR Photonic-Crystal Interband Cascade Lasers MIJIN KIM, CHUL SOO KIM, WILLIAM BEWLEY, CHADWICK CANEDY, JAMES LINDLE, JILL NOLDE, DIANE LARRABEE, IGOR VURGAFTMAN, JERRY MEYER, Code 5613, Naval Research Laboratory, Washington DC 20375, CODE 5613 NRL TEAM — Photonic-crystal distributed-feedback (PCDFB) semiconductor lasers have the potential to maintain optical coherence over very large areas. We report an electrically pumped PCDFB laser operating in a true single mode in the mid-infrared. A two-dimensional grating was formed on top of an interband cascade laser emitting at 3.3 μm by patterning a high-index Ge layer. The grating and the 400-μm-wide gain stripe were tilted by 20^o with respect to the facet. Current spreading was prevented by ion bombarding the region outside the gain stripe rather than etching of a ridge. The gain region at the back of the cavity was also terminated by ion bombardment, since feedback from the back facet is undesirable. A single mode was emitted with maximum cw output power > 60 mW, resolution-limited spectral linewidth (side-mode suppression ratio 27 dB), and single-lobe spatial far-field with angular full width at half maximum of 0.5^o. Comparison of the near and far field patterns indicated effective $M^2 \approx 3$. The observation of low efficiency is thought to be due primarily to inadequate grating coupling, which can be remedied by thickening the Ge layer.

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