Long Wavelength (1.55μm) InAs Quantum Dot Lasers on GaAs

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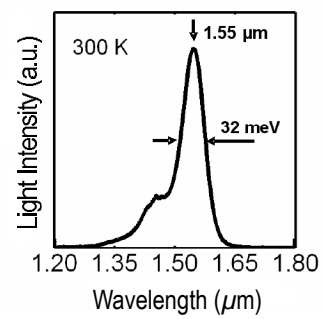
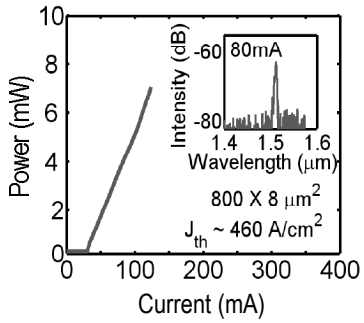
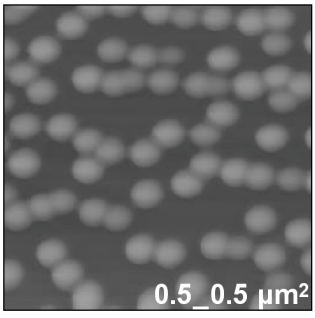
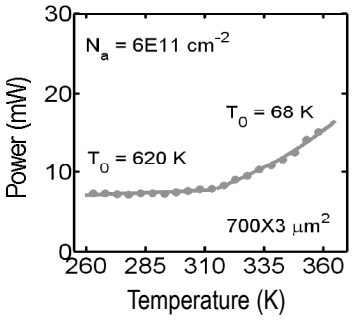
The conventional light source for long-haul optical communications has been InGaAsP/InP double heterostructure or multi-quantum well lasers, but these devices characteristically have high I_{th}, small T_0 (40K-50K), small T_1, and large values of chirp (2Å) and α-factor (~2–5). One promising approach is self-organized InAs quantum dot lasers. The performance of current 1.52μm InAs metamorphic QD lasers on GaAs, however, is limited by poor quality QDs [photoluminescence (PL) linewidth 70meV] and very high threshold currents (J_{th} 1000A/cm^2). By detailed investigation of the growth kinetics of the metamorphic heterostructures, we have demonstrated high performance 1.52μm QD lasers on GaAs, which exhibit J_{th}=460 A/cm^2, T_0 =620K, f_{-3dB} = 5GHz, chirp 0.3Å, α ~ 1.0, and present a practical alternative to the InGaAsP/InP technology. This project is being supported by Defense Advanced Research Projects Agency under award number HR 0011-04-1-0040.







Room-temperature PL spectra (top) and AFM image (bottom).



Light-current and output spectrum (top), and threshold current versus temperature (bottom).