

Spintronic Lasers for Polarization Control and Modulation

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Spin-polarized vertical cavity surface emitting lasers (spin-VCSELs) have been the subject of recent studies due to their potential for a host of applications in communication networks, cryptography, and reconfigurable optical interconnects. We have demonstrated, for the first time, electrically injected spintronic lasers with the quantum well and quantum dot active regions. We have investigated and analyzed the laser characteristics and variation of degree of output circular polarization with current bias for an InAs/GaAs self-organized quantum dot (QD) VCSEL with both ferromagnetic (FM) and non-magnetic contacts under an externally applied magnetic field in the Faraday geometry. Significant values of the degree of circular polarization ($\sim 8\%$) for devices biased near the threshold and a high threshold current reduction ($\sim 14\%$) are observed at an operating temperature of 200K. Currently, our work in this area is focused on designing and fabricating a spin laser capable of operating at room temperature. This project is being supported by the Office of Naval Research under award number N 00014-06-1-0025.

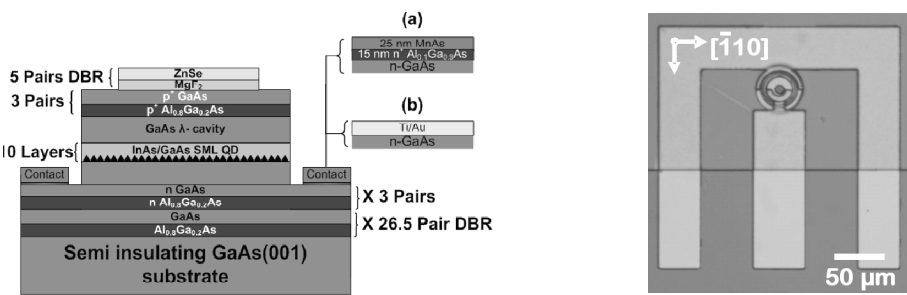
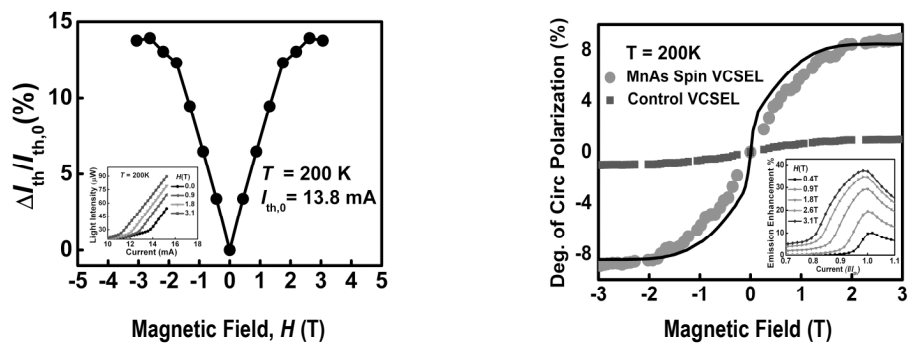


Illustration (left) and photograph (right) of a fabricated spin-VCSEL.



Plots showing threshold current reduction (left) and degree of circular polarization (right).