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High power laser from InGaAs/GaAs multiple-quantum-well optical thyristors operating at 1.04 μm

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High power laser from InGaAs/GaAs multiple quantum well (MQW) PiNiN depleted optical thyristors operating at 1.04 μm is presented for the first time. The optical thyristor lasers are based on a GaAs substrate and the epitaxial structure includes four InGaAs/GaAs strained quantum wells grown by Metal-organic Chemical Vapor Deposition (MOCVD). The thickness and doping concentration of the center layers as well as other growth conditions such as growth temperatures are designed carefully for the full structure. In the broad area laser fabrication, the P+ contact was made using a thermal evaporation process of Au/Zn, then generated the ohmic contact after annealing, and N+ contact layer was contacted with Au/Ge/Ni after lapping the GaAs substrate down to 100 μm. The optical thyristor lasers clearly show a nonlinear S-shaped current-voltage and lasing characteristics. It is shown that the optical properties of this structure include a low threshold current density and high output light power at room temperature. For a representative broad area laser with cavity length of 300 μm and width of 200 μm, the measured switching voltage and current are 4.15 V and 2.3 mA, respectively. The holding voltage and current are 2.63 V and 3 mA, respectively. A low threshold current density of 533 A/cm^2 and a high output light power of 30 mW per facet are achieved. The lasing wavelength is centered at 1.04 μm at a bias current equal to 1.5 times threshold. All these merits make this type of device attractive for optical processing and biomedical applications.

Biography

Ying Ding completed his Ph.D. from Institute of Semiconductors, Chinese Academy of Sciences, China in 2005. From 2005, he was a Postdoctoral Researcher in RCIQE, Hokkaido University, Japan, where he was engaged in research on semiconductor nanowires. In 2008, he joined the Nanyang Technological University, Singapore, as a Research Fellow, where he was engaged in study on QW and QD-VCSELs. He is currently a Senior Research Fellow at the University of Dundee, U.K and his current research interests include high power and ultrafast optical devices. Ying Ding has authored and co-authored over 60 papers in peer-reviewed journals and conferences proceedings.

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