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Doping technologies for InP membranes on silicon for nanolasers

We present a systematic study of Zn thermal diffusion and Si ion implantation with subsequent rapid thermal annealing as the methods to fabricate lateral p-i-n junctions in InP membranes on silicon for use in electrically pumped in-plane nanolasers. We describe in detail optimized fabrication steps, which include MOVPE growth of InGaAs/InP epilayers, 2" InP to 4" SiO₂/Si direct bonding, and several cycles of DUV lithography. Values for sheet resistance of p-InGaAs/InP and n-InP membranes are obtained, which correspond to carrier concentration levels higher than 10¹⁸ cm⁻³ for both Zn-diffused p-InP and Si-implanted n-InP.

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