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Low resistance ohmic contacts to n-GaAs for application in GaAs/AlGaAs quantum cascade lasers

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Keywords

ohmic contacts, sputtering, rapid thermal annealing (RTA), quantum cascade lasers (QCLs)

Abstract

This paper reports on the results of optimization of ohmic contacts for GaAs/AlGaAs quantum cascade lasers (QCLs). Technological parameters during optimization concerned surface preparation, evaporation method, and thermal treatment. The aim of this research was to obtain low resistance and time stable ohmic contacts. The average specific contact resistance was $6 \times 10^{-7} \Omega \text{cm}^{-2}$ with record value below $3 \times 10^{-7} \Omega \text{cm}^{-2}$. It appears that the crucial role in contact formation is played by the *in-situ* surface pretreatment and thermal processing. Circular transmission line method (CTLM) was applied for electrical characterization of Ni/AuGe/Ni/Au metallization system. Secondary ion mass spectroscopy (SIMS) was used for determination of Au diffusion into semiconductor. The system presented was used in fabrication of pulse operating QCLs. The lasers mounted with diamond heat spreaders on copper block cooled by liquid nitrogen (LN) achieved optical powers over 1 W, threshold current density values of 7 kAcm^{-2} and differential efficiencies above 1 W/A.



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