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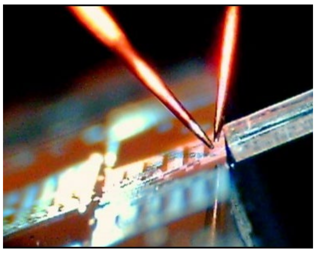

Summary

Research Thesis at IHT

Title: Strain Engineering of Microring Resonators Using SiN Stressors

Bildquelle: „Elektrisch gepumpter Kantenemitter mit Glasfaserkopplung", IHT, Universität Stuttgart

IHT field of competence „Photonic"

Keywords

SiN stressor, GeSn laser, Electrical CW lasing, MQW Lasers, Strain Transfer.

Summary: GeSn microring resonators are an emerging technology that holds great promise for achieving CMOS-compatible light emission. In this study, we delve into the Fabrication process of these microrings and explore their optical, and electrical characteristics.

To further enhance their optical properties, a bandgap engineering approach is employed, utilizing SiN stressor layers to modify the band structure of the Germanium-Tin alloy and transform it into a direct bandgap semiconductor with the aid of underetching.

In this work, a highly compressive SiN recipe of -1.8 GPa is developed using plasma enhanced chemical vapor deposition. Different parameters were varied to tune the strain such as temperature, pressure, power, frequency, etc. This recipe is the utilized in fabricating GeSn microring laser diodes and Ge p-i-n diodes. The Raman analysis showed a redshift of $\Delta\omega = 1.26\ cm^{-1}$ towards a tensile strain in the GeSn microrings after depositing the SiN which is confirmed later in the electroluminescence measurements where the bandgap was shifted by 23 meV as shown in Figure 1.

Furthermore, electroluminescence measurements were performed for different geometries of the fabricated GeSn microrings. The devices demonstrated the ability to lase using both pulsed and continuous wave (CW) electrical pumping, even at high operational temperatures of 95 K and 57 K, respectively.

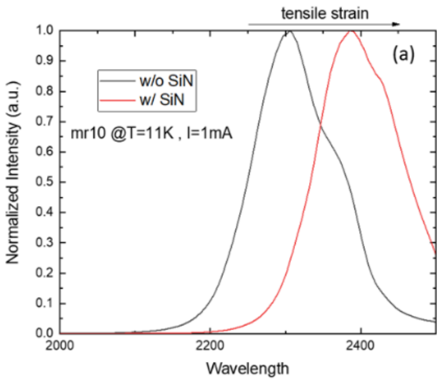

Fig. 1: Comparison of EL Spectra at 11 K for GeSn Microrings: Non-SiN vs SiN.

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