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LD-10

Photopumped Blue Lasers in ZnSSe-ZnMgSSe Double Heterostructures Operating up to 500K

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The first lasing operation was observed from ZnSSe-ZnMgSSe double-heterostructure (DH) photopumped blue lasers up to 500K. This result indicates that ZnMgSSe is a promising material for the cladding layer of a blue laser diode.

ZnSSe has been considered as a suitable material for the active layer of a blue laser diode. However, there have been no candidates for a cladding layer material that is lattice-matched to a (100) GaAs substrate and has sufficient band-gap energy. Then, we found a novel material, ZnMgSSe. The band-gap energy of ZnMgSSe can be varied from 2.8eV to near 4eV while maintaining the lattice-matching condition to the substrate[1].

The DH structure composed of ZnSSe and ZnMgSSe has been grown by molecular-beam epitaxy. The band-gap difference between ZnSSe and ZnMgSSe is 0.33eV. Based on the LCAO theory, the band-lineup for the heterojunction is type I.

Fig.1 shows the layer structure used for photopumped lasing. The optical cavity of the sample was cleaved to 800μm, and the width of the sample was cut to 500μm. This sample was excited by a pulsed N_2 laser. The wavelength and the pulse width of N_2 laser were 337nm and 5ns, respectively. Fig.2 shows the emission spectra below and above the threshold at room temperature (RT). It was observed that the light output intensity rapidly increased above the threshold. The lasing wavelength was 464.5nm and the full width at half maximum (FWHM) was 11meV at RT. The temperature dependence of the light output on excitation intensity is shown in Fig.3. The threshold was 105kW/cm^2 at 300K, and 185kW/cm^2 at 400K. The lasing up to 500K was confirmed by polarization. The characteristic temperature, T_0, was estimated to be 170K. The ZnSSe-ZnMgSSe DH structure is sure to be applied to a blue laser diode. Recently, both p-type and n-type doping in ZnMgSSe were achieved. We will also report on the electrical and the optical properties of chlorine and nitrogen doped ZnMgSSe.

1) H.Okuyama et al. : Jpn. J. Appl. Phys. 30 (1991) L1620.

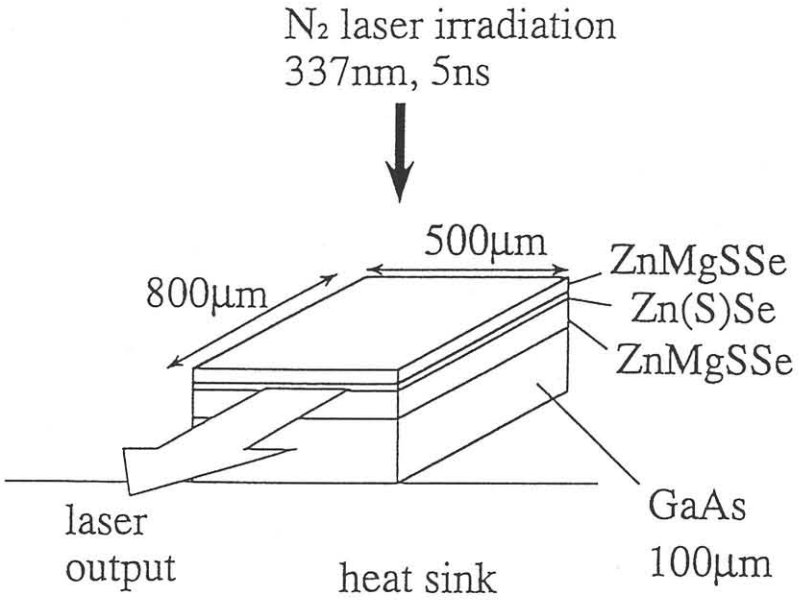

Fig.1 Schematic layer structure used for photopumped lasing

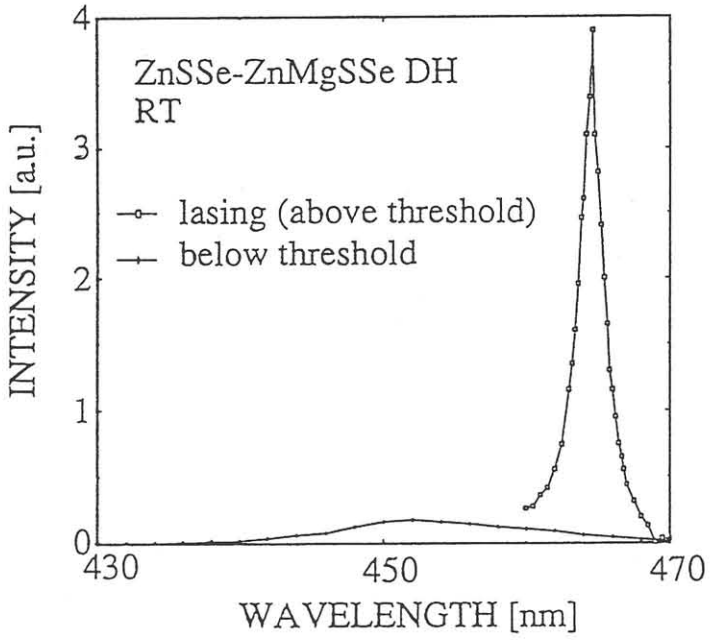

Fig.2 Spectra below and above the threshold

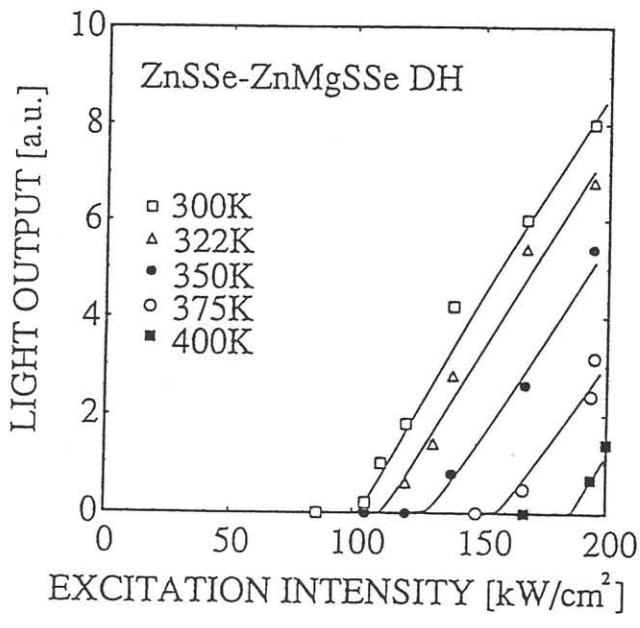

FIg.3 Light output vs excitation intensity at 300K-400K