

Photoluminescence And Electroluminescence Properties Of The Er-doped Silicon-Rich Silicon Oxide Films Deposited By Pulsed Laser Deposition Technique

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Silicon-based materials containing Er atoms are of great interest in silicon-optoelectronic technology, due to their Er^{3+} intra-4f emission at $1.54 \mu\text{m}$, the standard optical communication wavelength. In these materials the Er atoms may be excited by energy transfer of optically or electrically generated charge carriers in the basis materials. We deposited Er-doped SRSO(silicon-rich silicon oxide) films in O_2 atmosphere by using silicon target with Er-patch in PLD(pulsed laser deposition) system. The PL(photoluminescence) intensity at $1.54 \mu\text{m}$ was highly dependent on the oxygen content in the film⁽¹⁾. In order to increase the luminescence efficiency the ex-situ annealing process was employed at 500°C in O_2 atmosphere again. This process made the SRSO films more stoichiometric to SiO_2 , so that the observed PL intensities increased several times in infrared range around $1.54 \mu\text{m}$. To study the electrical excitation of the Er atoms, we manufactured Er-doped SRSO light emitting diode containing a p-n junction structure, and observed EL(electroluminescence) in the infrared ranges under several forward bias voltages. The EL spectra showed several broad peaks from 1.25 to $1.63 \mu\text{m}$ above the on-current density of 3 A/cm^2 . In this report we discuss the luminescence property of the Er-doped SRSO films with the energy transfer from the SRSO basis or from the silicon nanoclusters.

[참고문헌]

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