SUPERLINEAR ELECTROLUMINESCENCE DUE TO IMPACT IONIZATION IN GASB-BASED HETEROSTRUCTURES WITH DEEP AL(AS)SB/INASSB/AL(AS)SB QUANTUM WELLS


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Abstract
We report observation of superlinear electroluminescence in nanoheterostructures based on GaSb with a deep narrow Al(As)Sb/InAsSb/Al(As)Sb quantum well in the active region, grown by metal organic vapor phase epitaxy. Electroluminescent spectra were obtained for different driving currents at temperatures of 77 and 300 K. It is shown that such structure exhibits superlinear dependence of optical power on the drive current and its increase of 2-3 times. This occurs due to impact ionization in Al(As)Sb/InAsSb quantum well in which a large band offset at the interface DEc=1.27 eV exceeds ionization threshold energy for electrons in the narrow-gap well. Calculation of the size quantization energy levels is presented, and possible cases of impact ionization, depending on the band offset DEc at the interface and on the quantum well width, are considered. This effect can be used to increase quantum efficiency and optical power of light emitting devices (LEDs, lasers), as well as for photovoltaic elements.

Keywords: Quantum wells, Superlinear electroluminescence, GaSb, LEDs, Semiconductor lasers

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