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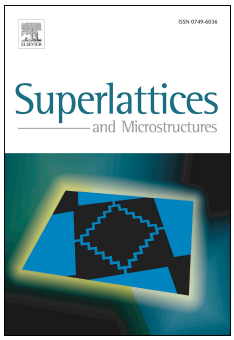

Nonlinear optical susceptibilities in the diffusion modified $Al_xGa_{1-x}N$/GaN single quantum well

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Nonlinear optical susceptibilities in the diffusion modified $Al_xGa_{1-x}N/GaN$ single quantum well

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Abstract

Under thermal treatment of the post growth AlGaN/GaN single quantum well, the diffusion of Al and Ga atoms across the interface is expected to form the diffusion modified quantum well with diffusion length as a quantitative parameter for diffusion. The modification of confining potential and position-dependent effective mass in the quantum well due to diffusion is calculated taking the Fick's law. The built-in electric field which arises from spontaneous and piezoelectric polarizations in the wurtzite structure is included in the effective mass equation. The electronic states are calculated from the effective mass equation using the finite difference method for several diffusion lengths. Since the effective well width decreases with increasing diffusion length, the energy levels increase with it. The intersubband energy spacing in the conduction band decreases with diffusion length due to built-in electric field and reduction of effective well width. The linear susceptibility for first-order and the nonlinear second-order and third-order susceptibilities are calculated using the compact density matrix approach taking only two levels. The calculated susceptibilities are red shifted with increase in diffusion lengths due to decrease in intersubband energy spacing.

Key words: Quantum well; diffusion modified quantum well; nonlinear optical properties.

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