Nanooptics and photonics

Photoconductivity and photoluminescence transients of InGaAs-GaAs quantum wire modulation-doped heterostructures

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Characteristics and optical properties of charge carrier's transport in quantum-dimensional heterostructures based on semiconductor III-V materials are widely studied by scientists in recent years [1-2]. Films of InAs quantum dots (QD) and quantum wires (QWR) are used as the active material in the p-i-n solar cells, increasing of power conversion efficiency to 28.8% [2]. Description of charge transport in thin films containing semiconductors QDs or QWRs is off high importance for device applications and understanding fundamental physics.

The photoconductivity and photoluminescence transients for samples with different morphologies and coverage monolayers number of the InGaAs nanostructures are investigated.

Comparing the PL and PC spectra for samples with different morphologies of the InGaAs nanostructures, we conclude that difference in photoluminescence decay constants is determined mainly by recombination probability inside the QWRs. While the photoconductivity decay depends on carrier dynamics and recombination in the conductivity channels. In both cases, the relaxation rates largely depends on nanostructure's size and composition, energy disorder due to inhomogeneous distribution of strain and piezoelectric fields around the nanostructures. This field has a strong impact on efficiency of carrier exchange between bands of the InGaAs QWRs, GaAs spacers or wetting layers.

1. *Bailey C. G., Forbes D. V., Raffaelle R. P. and Hubbard S. M.* Near 1 V open circuit voltage InAs/GaAs quantum dot solar cells// Appl. Phys. Lett.- 2011.- **98**, N 16.-P. 163105.

2. *Yablonovitch E., Miller O. D. and Kurtz S. R.* The opto-electronic physics that broke the efficiency limit in solar cells Photovolt. Special. Conf/ IEEE. -2012. -**38**th. -P. 001556-001559.