EXTENDED DEFECT STATES IN Ge QUANTUM DOTS AND GeSi QUANTUM WELLS

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The multilayer structures of Ge-QDs or GeSi-QWs have been demonstrated the possibility of the interband and intraband transitions in mid-infrared ranges. QDs and QW interfaces of GeSi quantum structures could be considered as giant defect states for recombination of charge carriers. In spite of the promising applications of Ge/Si quantum structures, the existence of defect states localized near QDs and QWs should be considered for the requirement of the high radiative efficiency and the inhibited phonon scattering expected in these structures. 10 period Ge-QDs or GeSi QWs were grown by using a solid-source molecular beam epitaxy (MBE) system. The p-i-n structure with QDs or n-i-n with QWs for IR detectors were capped with the p-Si layer of 100 nm and the photodiode with a MESA pattern was fabricated by a chemical etching method, repectively. Time-resolved optical capacitance spectroscopy methods allow investigation not only of the electronic level structure of the quantu

m structures, but also of the dynamics of emission and capture processes.

In this paper, we report that the existence of defects states in the structures with QDs or QWs can be examined and that an origin of the defects is identified. Figure 1 shows optical-DLTS spectra for the sample embedded with Ge-QDs and the signal which is responsible for the ground state of the valence band offset(VBO) appears dominantly near 93 K and their activation energies (E_T) is calculated to be E_V + 177 meV with an optical capture cross section of 2.1×10^{-14} cm^2, And an identification of extended defect states in the

sample with GeSi-QWs will be presented.

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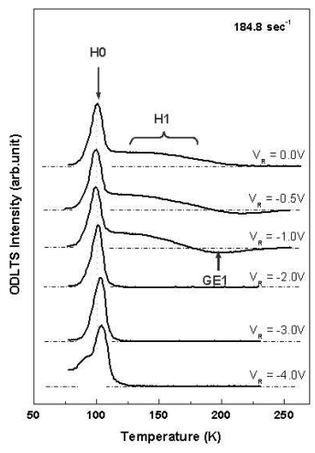

FIG. 1 Optical-DLTS spectra for the sample with Ge-QDs