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Energy level tuning of InAs quantum dots by coherent strain layers

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We investigated the effect of GaAs/Al_xGa_{1-x}As superlattice barriers with different positions and compositions on the optical properties of InAs QDs to apply for the absorption region of from 1.1 to 1.4eV. All samples were grown by solid source Molecular Beam Epitaxy (MBE) system on the semi-insulating (001) GaAs substrates. The photoluminescence (PL) measurements were performed at 16K and showed that the structure with upper GaAs/Al_xGa_{1-x}As superlattice barriers was shifted without sacrificing emission property. In this case we can make an expectation that the increased radiative photocurrent due to the higher emission intensity could effectively increase the efficiency of solar power conversion. The energy level shift could be explained by the energy level modification due to high potential barrier⁽¹⁾. And we certified that the increase of aluminum composition cause the more shifted emission peak. As a result, we confirmed the possibility to apply for the absorption region for solar cell by GaAs/AlGaAs superlattice with suitable structure and Aluminum composition.

[Reference]

1. U.H. Lee, D. Lee, H. G. Lee, S. K. Noh, J.Y. Leem, Appl. Phys. Lett., 74, (1999) 597