(113)B GaAs 基板上に成長した量子ドットの PL の温度依存性

Temperature dependence of PL of quantum dots grown on (113)B GaAs substrate

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Self-assembled InAs Quantum dots (QDs) grown on high-index such as (113)B GaAs substrates has potential applications for nonlinearity optical devices because the effective second-order nonlinear coefficient is zero on (100) orientation due to the crystal symmetry. However, Photoluminescence (PL) from wetting layer (WL) tends to be dominated for InAs QDs grown on (113)B GaAs by molecular beam epitaxy (MBE). We have found that 0.5 ML AlAs cap is an effective way to suppress WL PL and obtained QDs PL at room temperature [1].

It is essential to understand the temperature dependence of PL of QDs in order to improve the characteristics of QD based devices. Temperature dependence PL of QDs without and with AlAs cap were shown in Fig. 1. The activation energy (Ea) for PL quenching can be determined by fitting the PL intensity to $c/(1+A\exp(-E_a/k_BT))$, where c is a constant value, A is a fitting parameter, k_B is the Boltzmann's constant. The different temperature dependence of PL between QDs without and with 0.5 ML AlAs cap could be result from the changing of WL, which was reduced by AlAs due to phase separation.

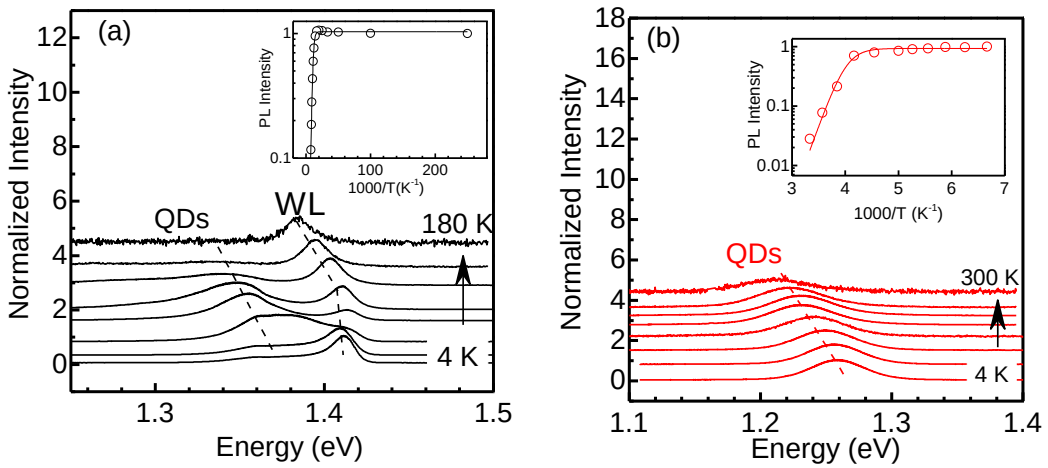

Fig. 1. PL temperature dependence of (113)B QDs without AlAs cap (a) and with 0.5 ML AlAs cap (b), respectively. Inset shows the fitting results.

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