単一 InGaN 量子ドットにおけるスペクトル拡散の励起レーザー波長依存性の測定

Measurement of the excitation laser wavelength dependence of spectral diffusion from a single InGaN quantum dot.

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Thanks to the widely tunable emission wavelength range from the UV, though the visible, and into the IR, and the relatively large operating temperature range from cryogenic to room temperature and above, III-Nitride quantum dot (QDs) based single photon emitters have been attracting more and more attention in recent years. However, III-Nitrides suffer from pronounced spectral diffusion due to the interactions between the emitters and the charge fluctuations in the surrounding environments.

In this work, we investigate the fast temporal scale spectral diffusion in single self-assembled MOCVD grown InGaN QDs under different excitation conditions with continuous wave lasers (using wavelengths of 355nm, 375nm, and 400nm: allowing excitation both above and below the GaN bandgap). Emission spectra were measured using a nitrogen cooled CCD attached to a 30cm spectrometer (with a 1200lmm^{-1} grating) and fast spectral diffusion times where then measured through spectrally filtered photon autocorrelation measurements [1]. While the sample was excited at energies above the GaN bandgap (355nm), the QD exhibited a broad emission linewidth of ~4.5meV (see figure 1). Under these conditions the time scale of spectral diffusion was measured to be on the order of ~100ns (see figure 2). However, when the excitation wavelength was tuned to below the GaN bandgap (375nm and 400nm, but maintaining the same excitation power), we observed that *both* the linewidth broadening and the spectral diffusion rate were suppressed (linewidth → ~2meV, spectral diffusion time →~200ns). This resulting spectral diffusion suppression is due to our selective excitation of the environment, and provides hope that we may be able to control this phenomenon in future.

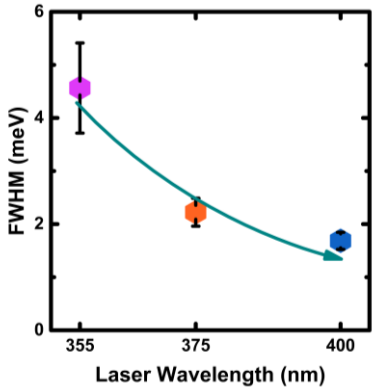

Figure 1. Emission linewidth from a single self-assembled InGaN QD under three CW lasers.

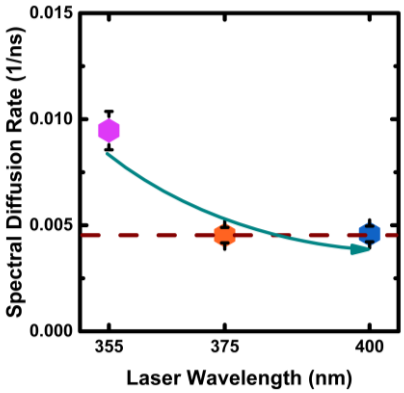

Figure 2. Fast time sca1e of the spectral diffusion of the studied InGaN QD under different lasers.

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