Quantum Dot Nanowires For Telecom Single Photon Emission at Elevated Temperatures

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Single photon emitters are key components for enabling the practical use of quantum key distribution protocols for secure communications. For long-haul, fiber-based optical networks, it is imperative to use photons that can carry quantum information over standard single mode fibers with the lowest attenuation coefficient. In this contribution, we present recent work on the position-controlled growth of nanowires using chemical beam epitaxy [1-2]. We demonstrate bright, single photon emission at 1310 nm using an $InAs_xP_{1-x}/InAs_yP_{1-y}$ single quantum dot-in-a-rod embedded within an InP photonic waveguide nanowire. At 4 K, we measure 1.9 million counts per second (Mcps) at the detectors at saturation under pulsed laser excitation at 80 MHz. An end-to-end brightness of approximately 2.4%, with a brightness at the first lens of 27.6% is achieved [3]. Temperature dependent, second-order correlation measurements show that these nanowire sources can generate single photons up to temperatures of 220 K. Single photons, with a multi-photon probability of 1.9 %, 12 %, and 34 % are obtained at 10 K, 77 K, and 220 K, respectively. The results achieved suggest that these photonic nanowires can be used as single photon emitters operating in the thermo-electric cooling regime.

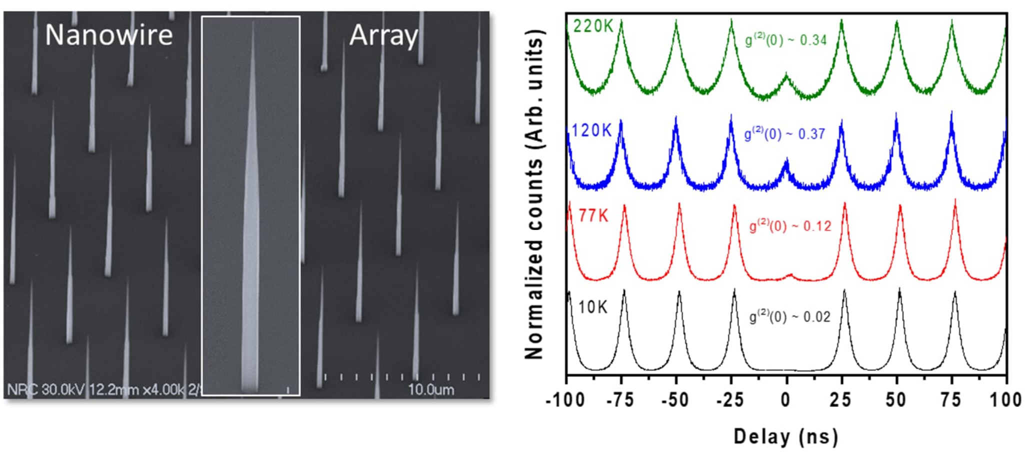

Figure 1: Left: Scanning electron microscope image of a nanowire array at 7.5um pitch. The inset is a typical SEM image of a single photonic nanowire that is individually characterized as a single photon emitter. Right: second order correlation measurements of a single nanowire as a function of temperature.

References

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