OPTICAL NANOSCOPY OF BARCODED SEMICONDUCTOR NANOWIRES

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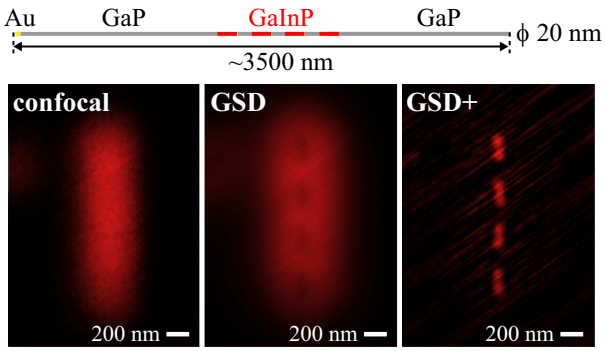

Artificial nanostructures offer an interesting alternative to molecular probes in biological sensing since the latter are subject to photobleaching, thus limiting signal and accessible optical resolution [1]. However, the use of nanostructures in biological contexts is still controversial due to their substantial size and surface chemistry that can lead to aggregation, limited permeability and increased toxicity in living specimens. Toxicity studies require a model sample whose shape and material composition can be altered during the growth procedure. Epitaxial growth of semiconductor nanowires fulfills these requirements. Further, least-invasive optical imaging methods are needed for precise identification and localization of nanostructures with respect to the cell compartments.

The success of optical nanoscopy techniques demonstrated over the past two decades encouraged us to investigate the internal photoluminescence of GaInP segments inserted in non-luminescent GaP nanowires ("barcodes") to increase the optical resolution for these emitters. We demonstrate that ground state depletion (GSD) nanoscopy can be used to resolve heterostructured nanowires with 5-fold resolution enhancement over conventional confocal microscopy [2]. The influence of barcode geometry on the raw-data image contrast (negative modality) is discussed. A more intuitive representation of images is retrieved by implementing Wiener deconvolution (GSD+). The simplicity of the GSD concept, which employs a single laser beam at the far-red excitation wavelength of ∼700 nm and the moderate power requirement of ∼3 mW (80 MHz repetition rate; 5 ps pulse duration) makes it an attractive imaging method for further biological investigations.

References:

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