# Exploring the Optoelectronic Properties of $CsPbBr_3$ Nanowires

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Metal-halide perovskites (MHPs) have brought a revolution in the field of photovoltaics due to their simple production process and unique optoelectronic properties. They are not only used in solar cells but also in light-emitting diodes, photodetectors, and lasers. Simultaneously they constitute an interesting material system for fundamental photo-physics investigation in bulk and quantum-confined regimes. So far the investigation of perovskite nanostructures has been dominated by the studies of their 0D [1] and 2D [2] forms however quasi-1D nanowires can also be obtained [3]. These nanowires can be used as potential components in various applications, showing properties such as low threshold lasing and polarity-dependent photodetection. Moreover, the $CsPbBr_3$ nanowires, are more stable than bulk forms.

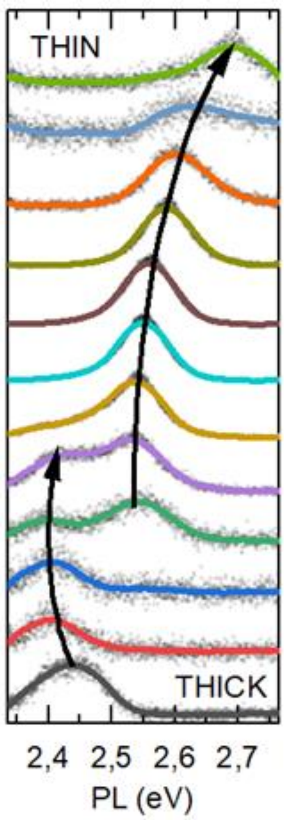


*Fig. 1. Normalized PL spectra of photoluminescence emission taken at different points along the nanowire*

Here we show our investigation of the optical properties of stable, single-crystal $CsPbBr_3$ nanowires grown by surface-guided chemical vapor deposition [3], which reflect the symmetry or morphology of their sapphire substrates. These horizontal $CsPbBr_3$ nanowires, guided on surfaces, present unusually large size-dependent emission blue shifts, significantly beyond the quantum confinement regime, related to substantial and uniform lattice distortion due to heteroepitaxial strain and lattice relaxation. Such wires provide a great opportunity to study the continuous evolution of the band-structure parameters due to strain in metal halide perovskites.

We will show detailed photoluminescence, time-resolved photoluminescence and reflectance characterization of $CsPbB_{r3}$ nanowires characterized by the strong change of their optical response along the wire length. We will show how the strain modulation impacts the structural phase transition of $CsPbBr_3$ nanowires and how the 1D form affects the polarization of the emitted light.

[1] A. Dey et al., ACS Nano 2021, 15, 7, 10775–10981

[2] Y. Chen, et al., Adv. Mater. 2018, 30, 1703487.

[3] E. Oksenberg, et al. Nat Commun 11, 489 (2020).