

**BRIGHT AND EFFICIENT  
SOLUTION-PROCESSED  
QUANTUM ROD-BASED  
LIGHT EMITTING DIODES  
WITH ENHANCED HOLE  
INJECTION**

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先進顯示與光電子技術  
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# HIGHLIGHTS

- Why QR-LED?
- Improving the hole injection into QRs via ultra-thin HAT-CN HIL
- Summary

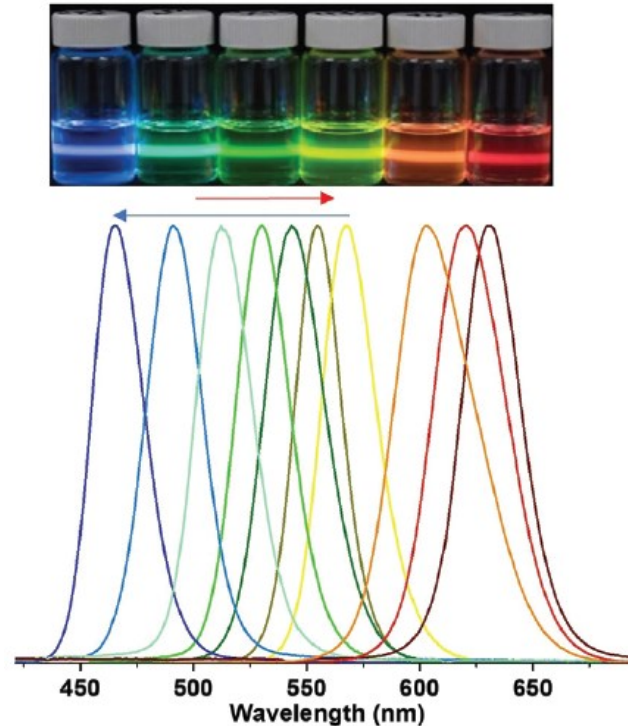
# 1. WHY QR-LED?

□ Current art-of-technology for LEDs use epitaxy growth techniques:

- ✗ Expensive
- ✗ Only inflexible devices
- ✗ Limited wavelength tunability

□ Benefit of QRs:

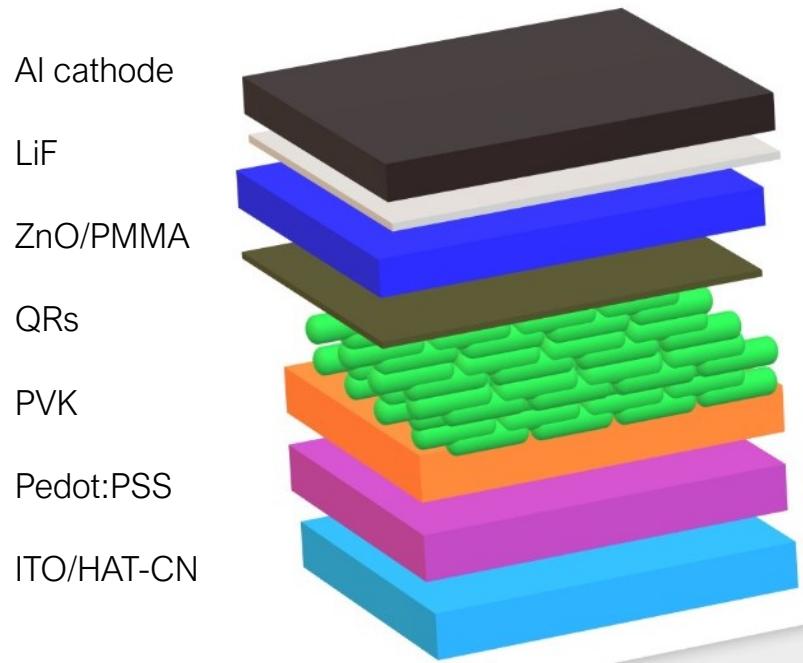
- ✓ Low cost (solution processed)
- ✓ Wide spectral tunability
- ✓ Polarized emission
- ✓ Flexible devices



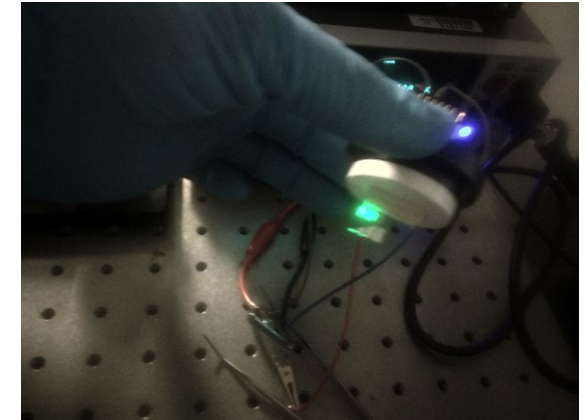
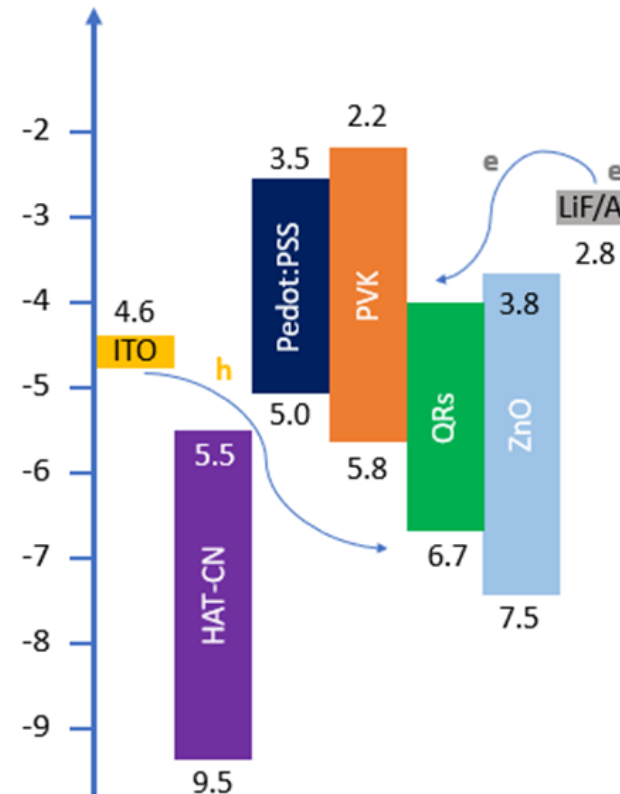
Prodanov, M. F., et al, Thermally Stable Quantum Rods, Covering Full Visible Range for Display and Lighting Application. *Small* 2021, 17, 2004487. <https://doi.org/10.1002/sml.202004487>

## 2. IMPROVING THE HOLE INJECTION INTO QRS VIA ULTRA-THIN HAT-CN HIL

Device Structure

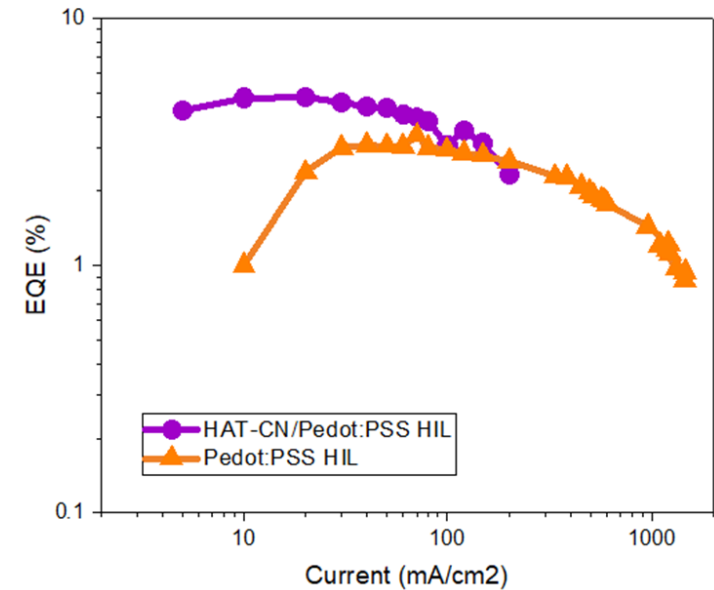
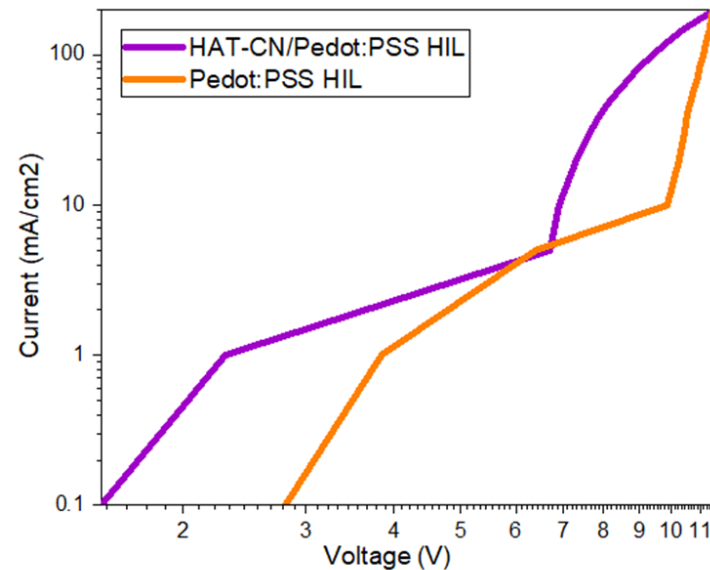
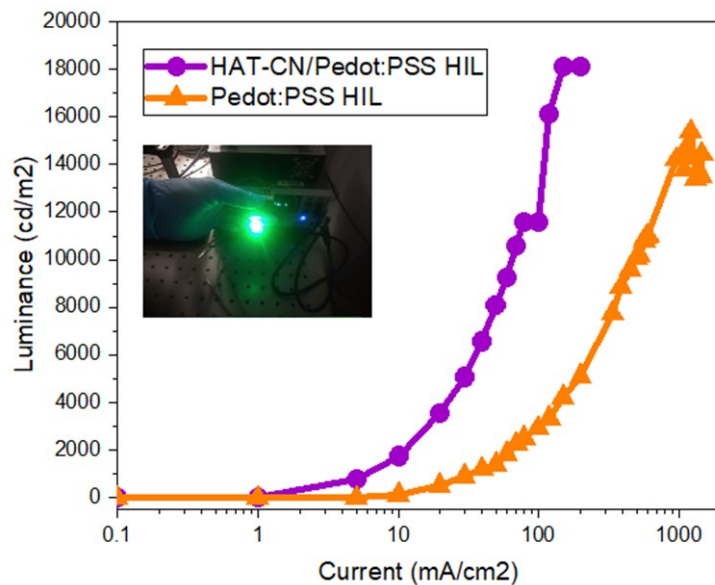


Energy Level Diagram



Mallam K., et al, Solution processed red, green, and blue light emitting diodes based on low-cadmium quantum nanorods, unpublished, 2021

### 3. IMPROVING THE HOLE INJECTION INTO QRS VIA ULTRA-THIN HAT-CN HIL



- Owing to improved hole injection, HAT-CN treated QR-LED benefits from significantly lower turn-on.
- Max luminance of Reference and HAT-CN treated QR-LEDs are 15,400 and 18,110 cd/m<sup>2</sup>, respectively.
- Max EQE of Reference and HAT-CN treated QR-LEDs are 3.36 and 4.76%, respectively.

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## QR-LED SUMMARY



QR-LEDs offer cheap and scalable alternative to solid-state LEDs



QRs offer unique shape-related benefits: polarized emission & reduced non-radiative losses



Hole injection in QR-LEDs can be improved by adding HAT-CN HIL



THANK YOU FOR ATTENTION!

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