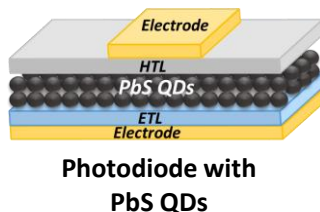
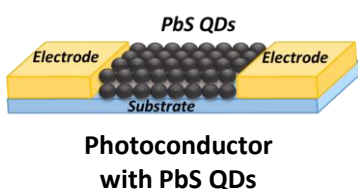


## PbS Quantum Dots for NIR Photodetectors

Near infrared sensing gains a widespread application in such devices as photo-cameras (for face recognition), autonomous cars (obstacles detection), AR and VR (for eyes tracking), in night vision and surveillance, biomedical imaging, quality control and product inspection. New sensor technologies are enablers for the digital transformation allowing us to integrate devices for IoT or collect Big Data. Current active NIR absorbers, such as InGaAs and Ge, have high cost of production (high temperature epitaxial method) and doesn't allow to combine with Si-based photodiode in a single device. PbS QDs have higher sensitivity, wider absorption range and compatibility with Si-based sensors.

### BENEFITS:

- Broad tunable absorption through all visible range to NIR 800 - 2000 nm
- High devices EQE
- High detectivity and short response time
- Facile integration with Si-based sensors (CMOS or Si photodiode) by solution spin-coating



### PERFORMANCE:

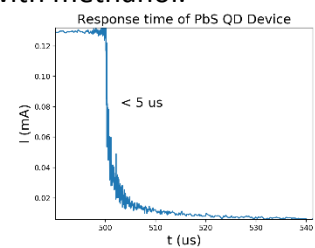
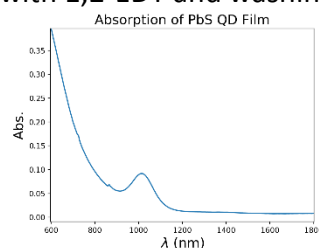
Material	PbS Quantum Dots
Absorption range	Through all visible up to NIR (tunable from 800 nm to 2000 nm)
Particle sizes	From 2.5 to 9 nm depending on the required absorption profile
Devices typical EQE	10-30 % upon excitation in NIR 50-70 % upon excitation in VIS
Devices typical response time	< 30 $\mu$ s
Devices typical detectivity	$10^{10} - 10^{13}$ Jones

### Products portfolio:

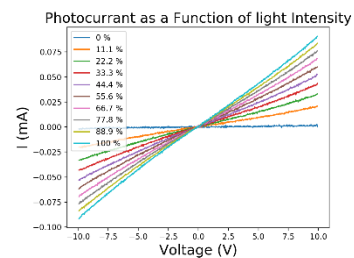
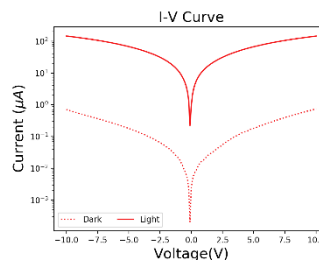
- [PbS \(Lead Sulfide\) Quantum Dots](#)  
PbS QDs, oleic acid capped, 800-2000 nm emission/excitonic absorption peaks

### EXPERIMENTAL DATA for QD-LS-980-abs (PbS QD, 980 nm excitonic absorption peak):

PbS QDs were used as an active layer in the photoconductor with gold electrodes. PbS QDs were deposited by spin coating (5-10 layers). Each layer processing consisted of spin coating of PbS QDs (octane, 50 mg/mL), followed by ligands exchange with 1,2-EDT and washing with methanol.



The device absorbs the light through all visible spectra up to 1100 nm with the first excitonic absorption peak 1015 nm (shifted from 980 in solution). The response time is < 5-20  $\mu$ s. I-V curve in dark/light modes shows that PbS QDs is a very sensitive material with the current linearly dependent on the light intensity.



### RELATED LITERATURE (with our contribution):

1. [Zhiyun Ning et al. Nature Materials 2014. V. 13, pp. 822-828](#)

