# Ligand Exchange on Semiconductor Nanocrystals

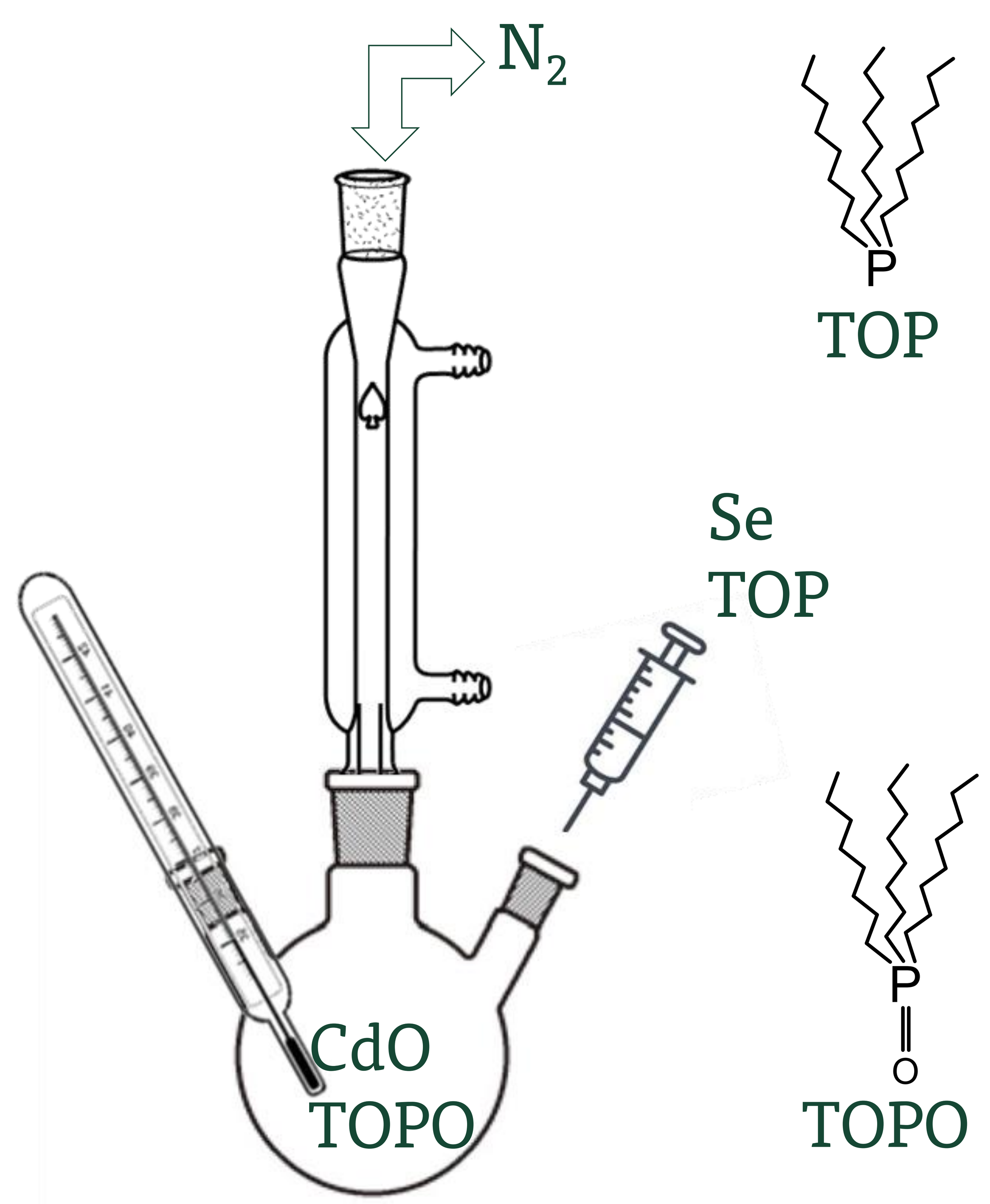
## Enhancement of the Charge-Transfer Process in Photoconductive and Photorefractive Nanocomposites

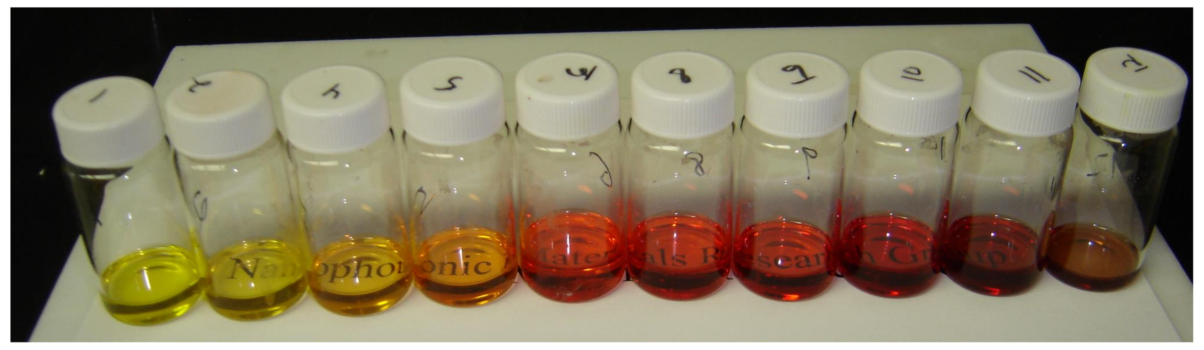
Jamie Christensen (OURE), Eric Deck (OURE), Dillon Thompson (OURE), Bennett Scott (FYRE), Jeffrey Winiarz (Dept. of Chem.)

### Introduction

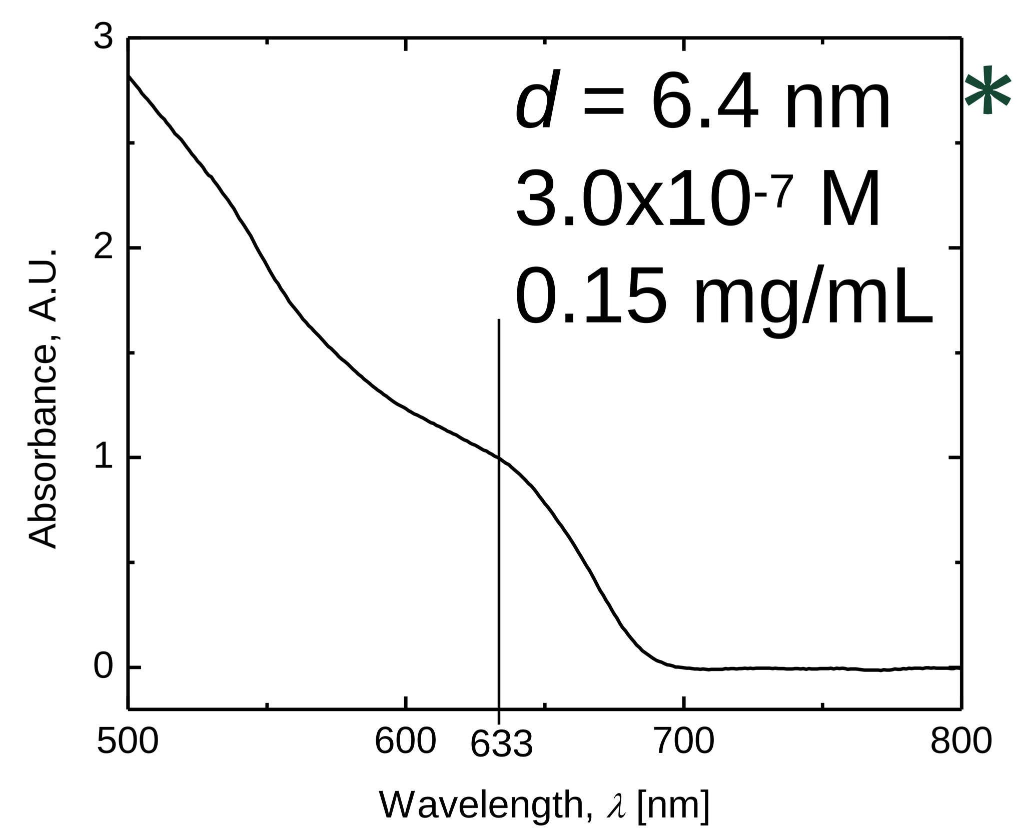
Advancements in semiconductor nanocrystal synthesis allow for their use in as photosensitizers in a variety of applications. However, traditional syntheses render the nanocrystals passivated with electrically insulative molecules such as trioctylphosphine. We speculate that here the charge-transfer process will be enhanced by replacing the native ligands with ones more conducive to the charge-transfer process.

### Colloidal Synthesis of QCdSe

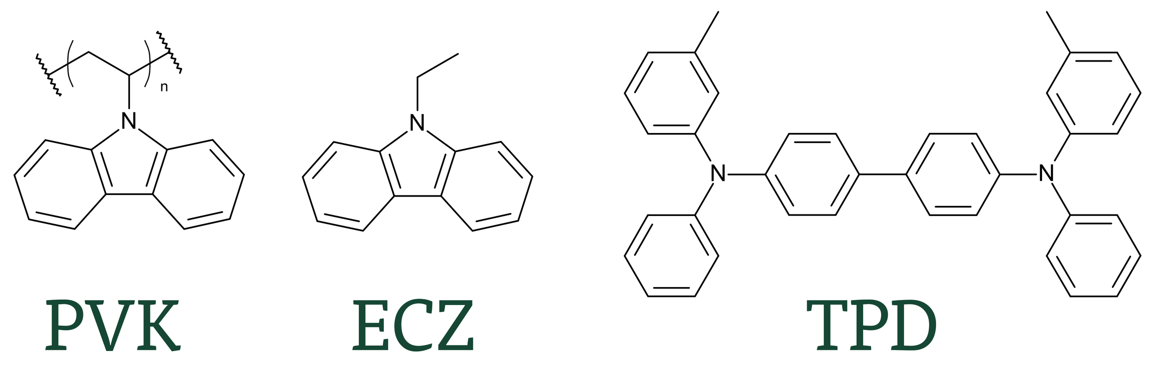


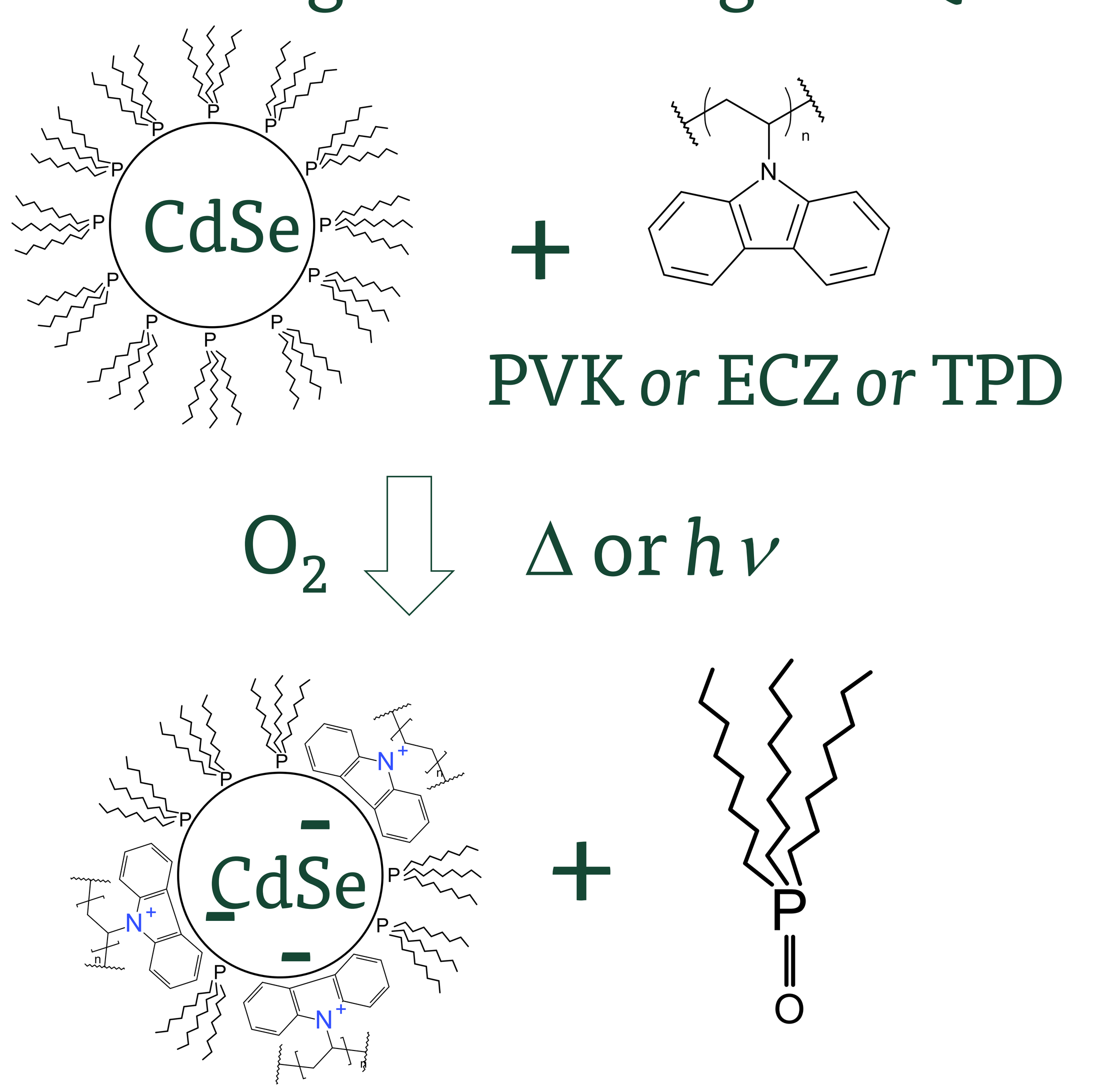
### QCdSe in Toluene




### CT Molecules Studied

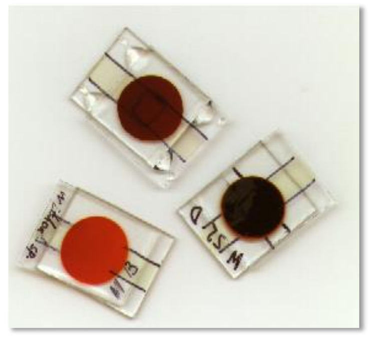



### Ligand Exchange on QCdSe

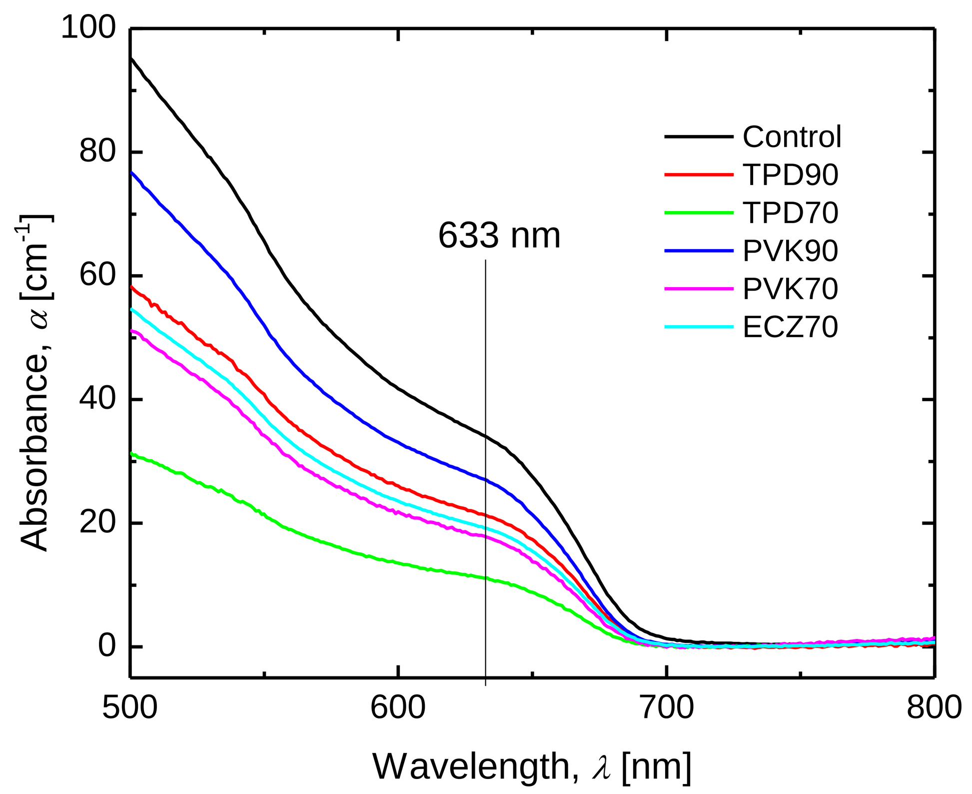


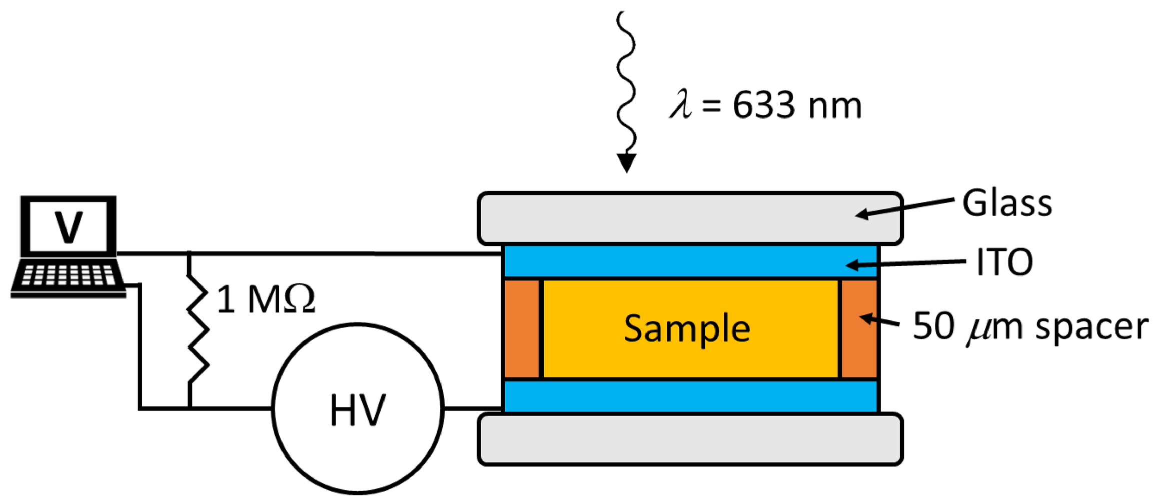

### Device Compositions

PVK: 33 wt%
ECZ: 33 wt%
TPD: 33 wt%
QCdSe: 1 wt%



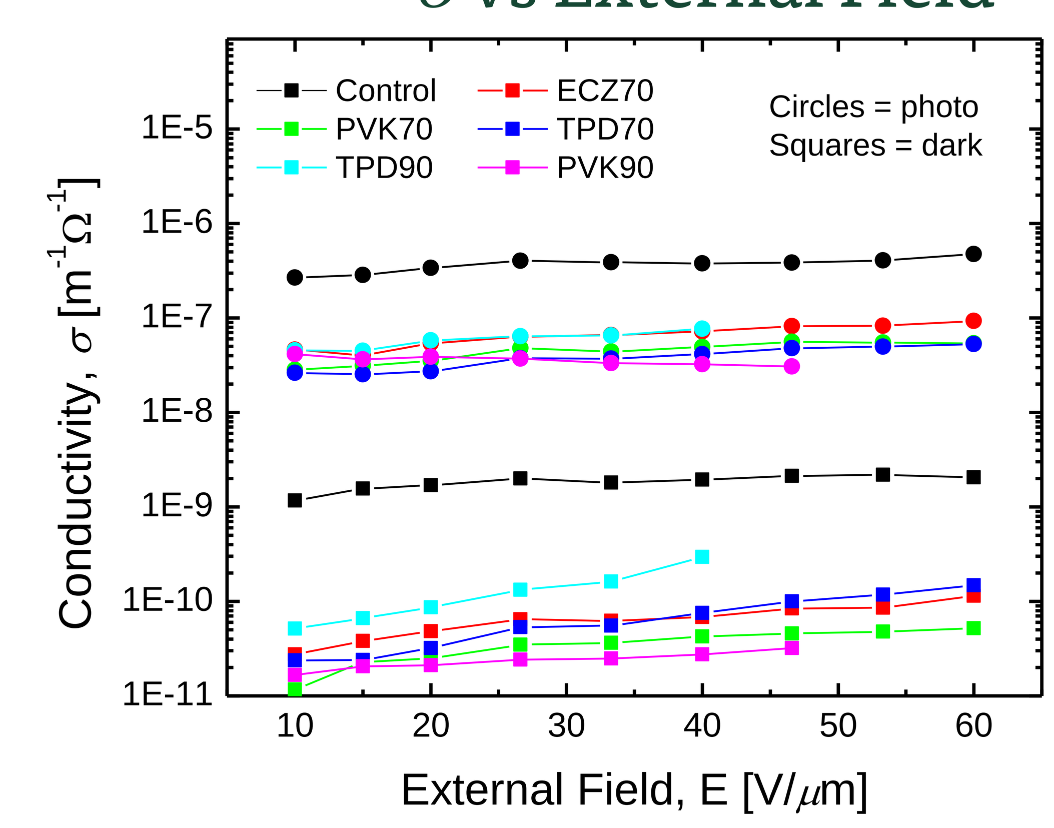
### Device Absorbances



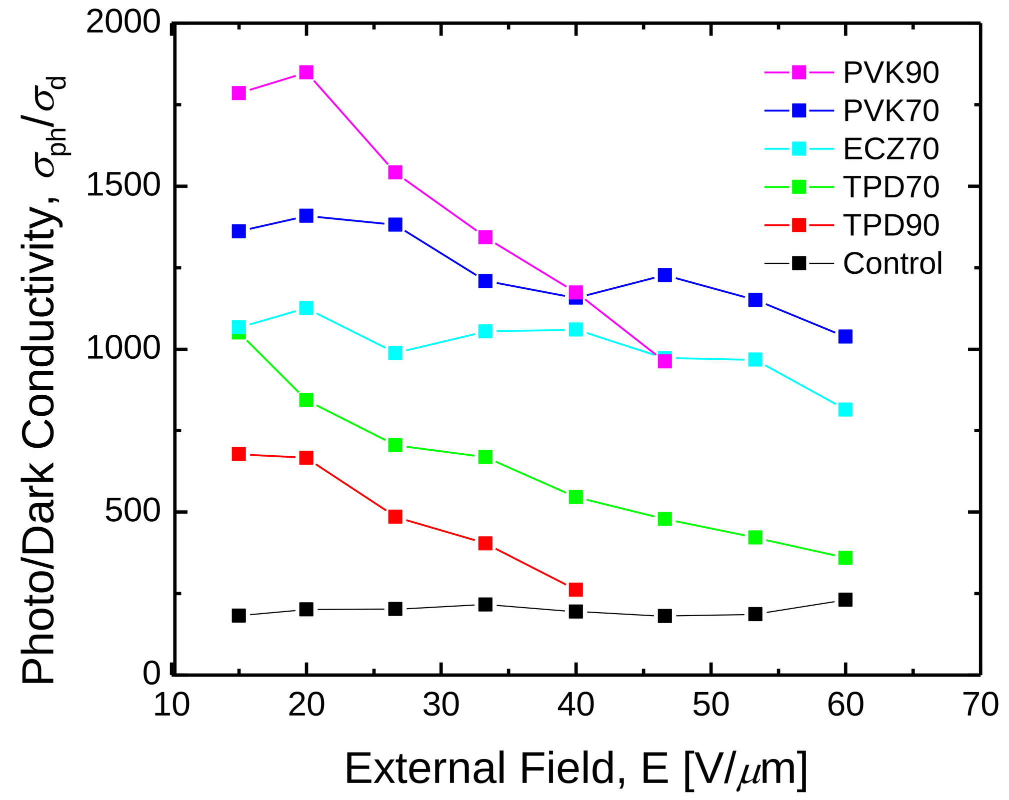




$$\sigma = \frac{V}{CRE}$$

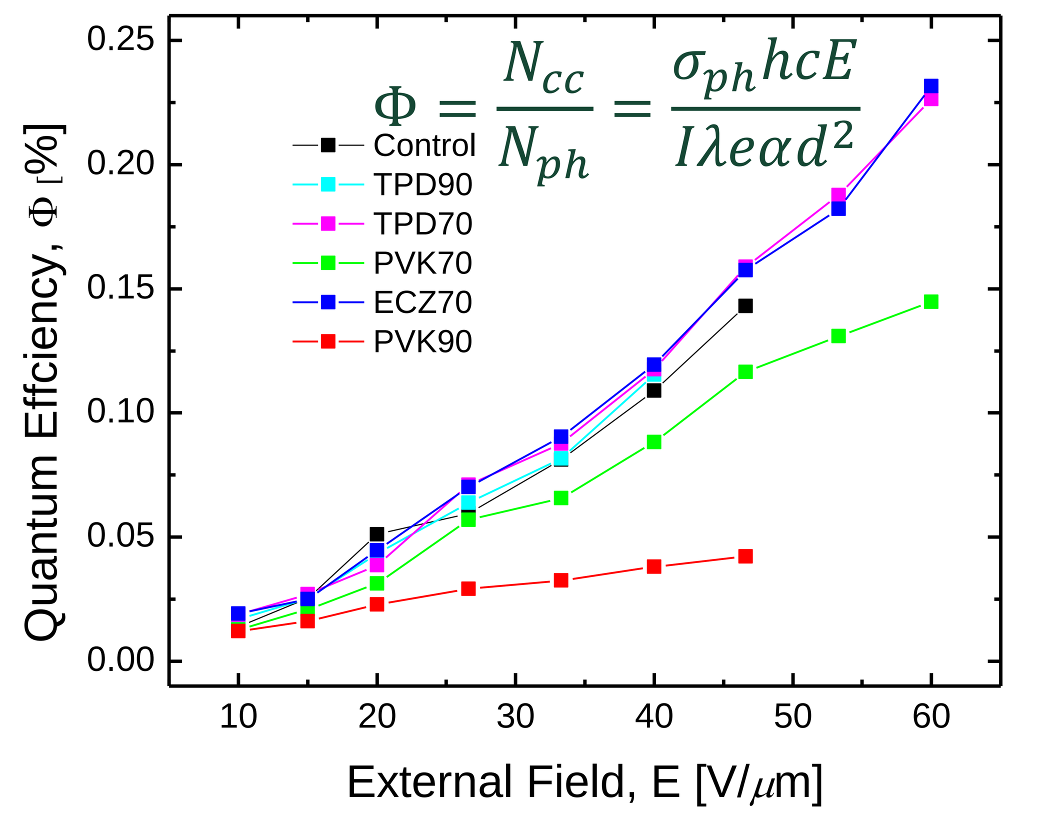
### σ vs External Field




### $\sigma_{ph}/\sigma_d$ vs External Field




### Quantum Efficiency vs External Field




### Conclusion

An enhancement in PC was not observed, however, a substantial decrease in DC was. While not anticipated, this approach may be useful for applications where the PC/DC is the relevant figure-of-merit, such as in photorefractive applications. Future studies will focus on determining the underlying reason for this behavior, which is likely rooted in a modification of the QCdSe surface characteristics, as well as the exploration of this approach in photorefractive composites.

*Yu, W. W.; Qu, L.; Guo, W.; Peng, X. Chem. Mater. 2003, 15, 2854.

Funded by Missouri S&T DoC, OURE, FYRE and CASE

MISSOURI S&T