Research Summary
(Independent Research)

Nathaniel Goenawan and Siddhant Pagariya

November 10, 2017

1 Background

The main topic that surrounds our research project is the use of CsPb-halide nanocomposites with organic passivating groups to make flexible LEDs. These CsPb-halide perovskites are a part of all halide perovskites, which are a subcategory of perovskites, which in the modern-day worldtodayhave become extremely viable and successful candidates in the generation and potential printability of different efficient light-emitting (screens) or absorbing (solar panels) displays.

These inorganic halide perovskites have recently attracted attention due to their promising potential as a low-cost and easily manufactured light emitting diodes (LED). However, while potentially cheap to manufacture, the efficient of the LEDs aren't optimal, there is still much room for improvement in both brightness and efficiency.

In addition, these perovskites material exhibit a high photoluminescence quantum yield or ratio of photon absorbed to photons emitted through fluorescence and high color purity or color saturation with narrow emission linewidths. These features make perovskites promising candidates as a new material for LEDs.

2 About the Research

2.1 Research Questions

1. What is the effect of size and shape of perovskite nanocomposites on LED efficiency?
2. What developments in the appropriate combination of perovskites will help improve the white light generation capabilities and efficiency?

2.2 Goal

Our overall research goal is to develop highly efficient white light generating light emitting displays that can be flexible.

3 Research Methodology

3.1 Procedures

A few steps we will be carrying out during this research project, are:

1. Synthesize perovskite nanocomposites of different sizes.
2. Make light emitting diodes from these perovskite nanocomposites.

4 References

1. Demchyshyn, S., Roemer, J. M., Groi, H., Heilbrunner, H., Ulbricht, C., Apaydin, D., ... & Scharber, M. C. (2017). Confining metal-halide perovskites in nanoporous thin films. *Science Advances, 3*(8), e1700738.

2. Li, J., Yu, Q., Gan, L., Chen, D., Lu, B., Ye, Z., & He, H. (2017). Perovskite light-emitting devices with a metalinsulatorsemiconductor structure and carrier tunnelling. *Journal of Materials Chemistry C, 5*(31), 7715-7719.

3. Zhang, L., Yang, X., Jiang, Q., Wang, P., Yin, Z., Zhang, X., ... & Sargent, E. H. (2017). Ultra-bright and highly efficient inorganic based perovskite light-emitting diodes. *Nature Communications, 8*, 15640.

4. Huang, H., Bodnarchuk, M. I., Kershaw, S. V., Kovalenko, M. V., & Rogach, A. L. (2017). Lead Halide Perovskite Nanocrystals in the Research Spotlight: Stability and Defect Tolerance. *ACS Energy Letters, 2*(9), 2071-2083.

5. Kim, Y. H., Cho, H., & Lee, T. W. (2016). Metal halide perovskite light emitters. *Proceedings of the National Academy of Sciences, 113*(42), 11694-11702.