Research Summary
(Independent Research)

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1 Background

Our research project involves the making of Light Emitting Displays (LEDs) using perovskites, which in the modern-day world, today, have become extremely viable and successful candidates in the generation and potential printability of different efficient light-emitting (screens) or absorbing (solar panels) displays. These perovskites, when applied on certain composites, like flexible materials, will allow for the creation of flexible displays, which could prove extremely useful for the mobile device industry today.

The specific type of perovskite we will be working with, in our project, is called a CsPb-halide perovskite since it is a subcategory of the halide perovskites which are primarily composed of halides, with an addition of Cesium and Lead in the molecular structure of these perovskites. These inorganic halide perovskites have recently attracted attention due to their promising potential as a low-cost, highly efficient, and easily manufactured LEDs. However, while potentially cheap to manufacture, the efficiency of the LEDs isn't optimal, there is still much room for improvement in both brightness and energy efficiency.

We will make use of CsPb-halide nano-composites with organic passivating groups to make flexible LEDs. The perovskite materials 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 line-widths. These features make perovskites promising candidates as a new material for LEDs. In combination of a highly likely candidate for LEDs and laying the material over nano-composites, we will be effectively creating flexible LEDs, on which, we will then test some of our research questions.

2 About the Research

2.1 Research Questions

1. What is the effect of size and shape of perovskite nano-composites on LED efficiency, i.e., the ratio of luminescence to amount of input energy into the LED?

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 nano-composites of different sizes.

2. Alter the shape, into for e.g., a square or circle, of the perovskite nano-composite, to the required size and dimensions through various chemical and physical modification techniques.

3. Make light emitting displays from these perovskite nano-composites.

4. Measure the luminance and color gamut using a Light meter of the different shape and sized LEDs that were synthesized, and record data.

4 Clarifications

1. **Flexible** here means that the LED can be bent to a certain maximum extent and that the LED will not break by simply cleaving the material through folding or bending the nano-composite material in any way, shape, or form up to the threshold level of stress.

2. **Shape and size**, the two main factors that will be the independent variables in our experiment, have yet to be studied more, in how they will be modified after the first successful batch of synthesized LEDs.

5 References

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