# Enhancing the Performance of Formamidinium Lead Halide Perovskite Solar Cells through Thin Film Engineering and Additive-Induced Ion Migration Control

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- **Background:**

Immerse yourself in the realm of **Perovskite Solar Cells** (PSCs), a groundbreaking photovoltaic technology poised to reshape the future of solar energy. PSCs, utilizing metal halide perovskite (MHP's) materials, offer a tantalizing blend of **high efficiency** and **easy fabrication**, capturing the spotlight for their potential revolution in solar energy due **to low production costs** and **versatile applications**.

- **Why $FAPbI_3$:**

Enter **Formamidinium Lead Halide Perovskite** (**$FAPbI_3$**), the heart of our research. **$FAPbI_3$** isn't just a compound; it's a solar superstar. With a **wider bandgap**, tolerance to **cation mixing**, and enhanced stability, **$FAPbI_3$** emerges as a promising candidate, a solar virtuoso ready to elevate solar technology to unprecedented heights.

- **Why $FAPbI_3$ Over Traditional Silicon:**

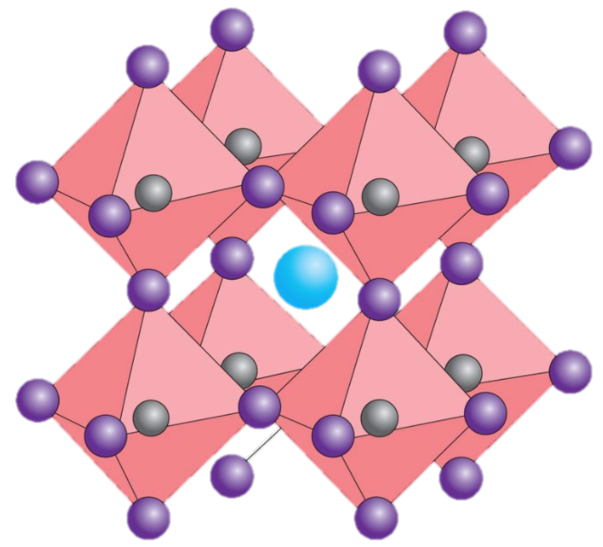
Challenge the status quo with **$FAPbI_3$** a solar maverick overtaking the traditional stronghold of silicon. Its wider bandgap captures a richer spectrum of light, ensuring unmatched efficiency. Tolerance to cation mixing reduces defects, and enhanced stability guarantees a solar lifespan that outshines the norm.

- **What obstacles are hindering the commercialization of this technology?**

However, its structural instability at ambient temperatures, transitioning from the metastable **α phase** to the less desirable **δ phase**, has hindered its application in solar cells.

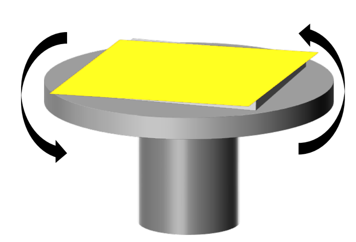
- **Introducing a transformative solution:**

The strategic integration of additives, including **Cesium** and **Rubidium**. This innovative approach not only bolsters **stability** but also effectively mitigates **ion migration**, minimizes **defects** and **traps**, and precisely optimizes the **bandgap**. It stands as a testament to cutting-edge innovation, marking a significant leap forward in the advancement of **materials science** and **solar technology**.

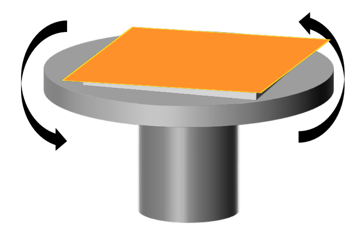


**$ABX_3$**

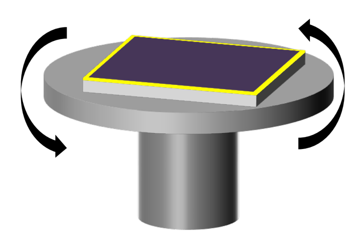
**Spin Coating**



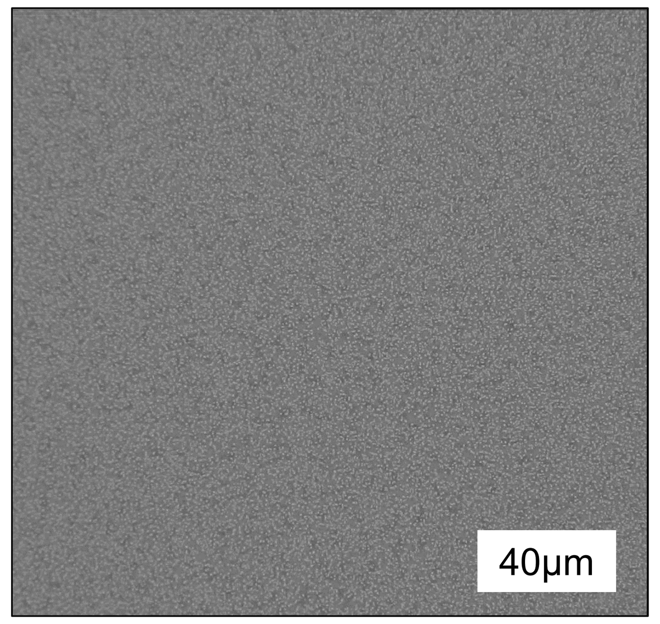
Dispensing 100 µL of PVSK onto the glass substrate.



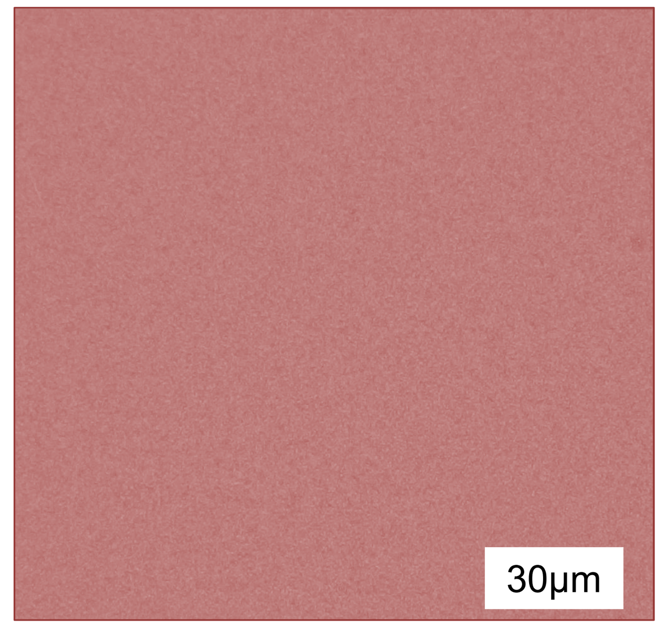
Adding the anti-solvent (chloro-benzene) in the final 3-4 seconds.



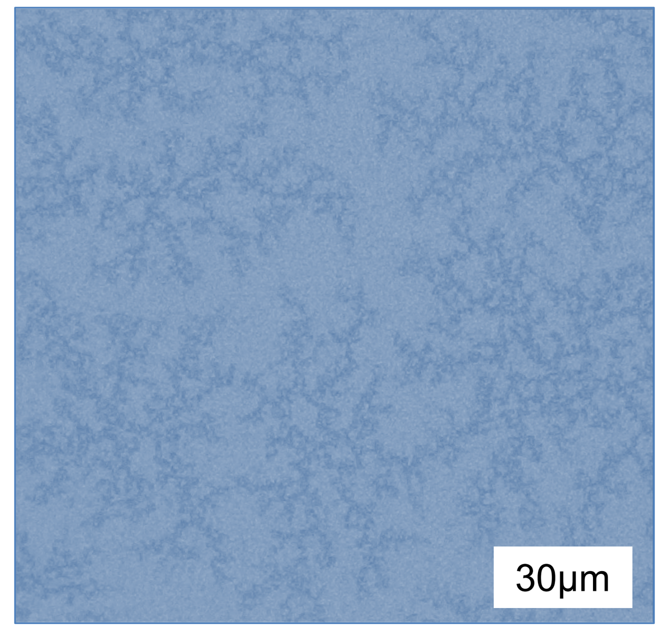
α - $FAPbI_3$
150 °C



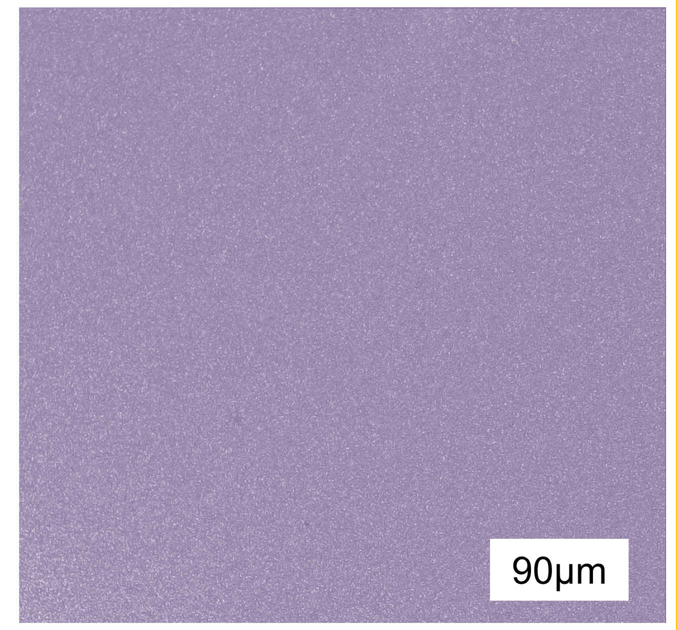

**$Cs_{0.2}FA_{0.8}PbI_3$**



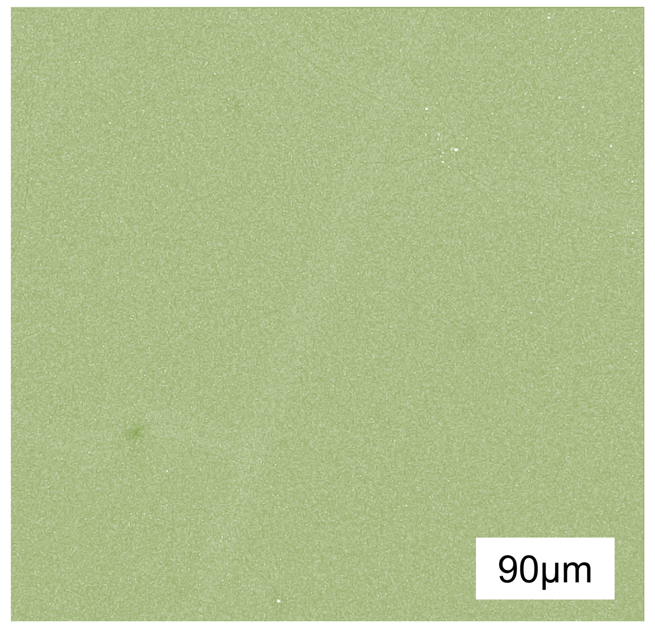

**$Cs_{0.1}FA_{0.9}PbI_3$+ 40% MACl**



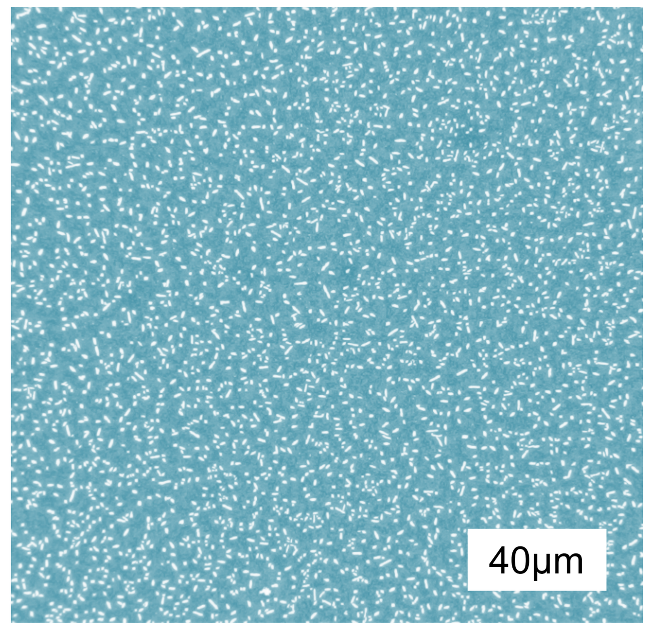

**$Cs_{0.1}FA_{0.9}PbI_3$**




**$FAPbI_3$ + 40% MACl**




**$FAPbI_3$**




**$Cs_{0.1}FA_{0.9}PbI_3$ + 5% Rb**

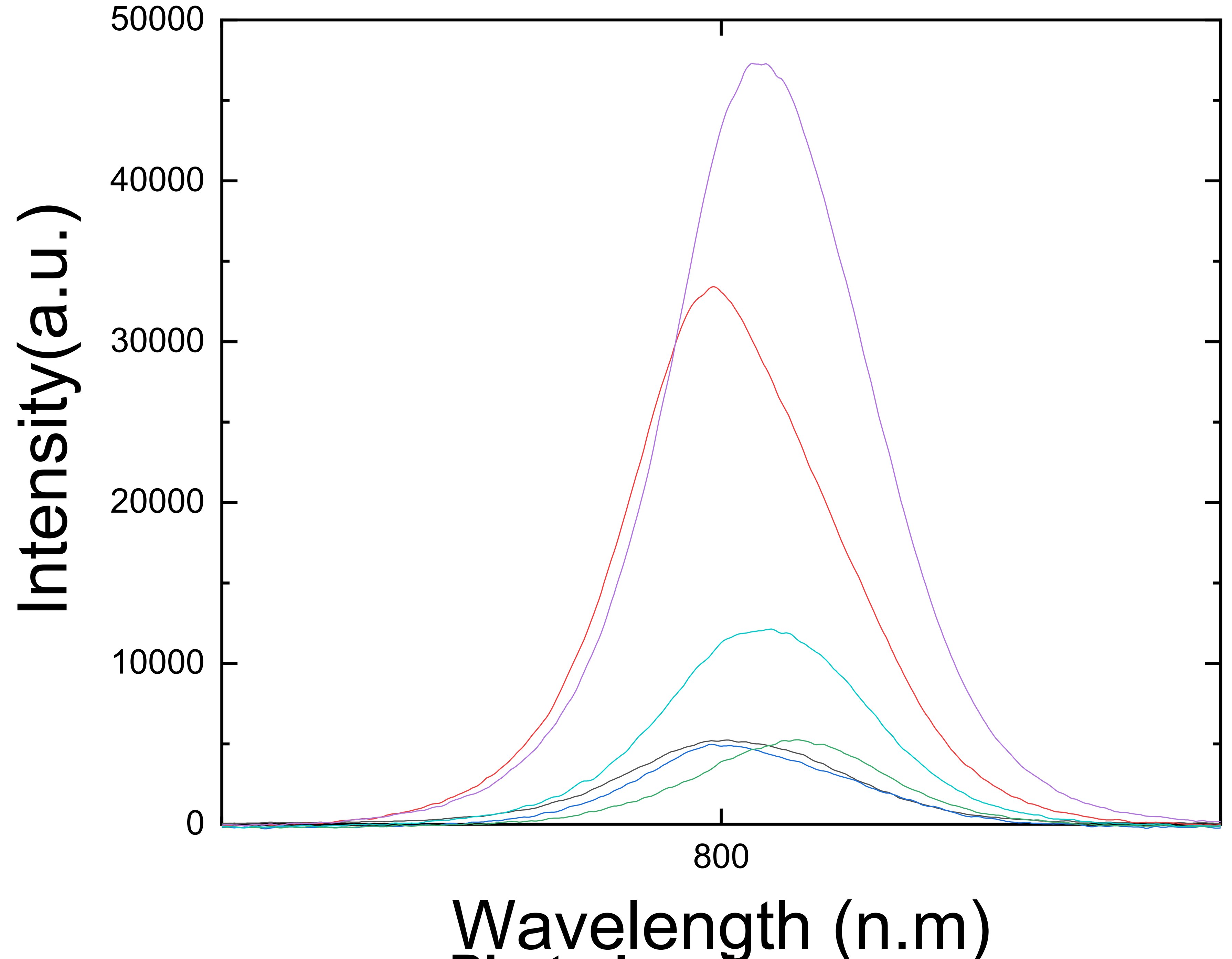



**Photo-Luminescence**

**Conclusion:**
The presented photoluminescence (PL) data reveals consistent wavelengths across various compositions, affirming the successful formation of thin films. Notably, the composition with 40% mol/v exhibits the highest intensity, indicating promising characteristics for further exploration.

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Future Endeavors:
In the pursuit of progress, the next phase involves a deep dive into the realm of thin films under the influence of additives. Specifically, the focus will be on understanding and enhancing ionic mobility for potential advancements in this dynamic field.

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