

# Increasing Perovskite Temperature and Light Stability Using 2D/3D Layering

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## Background

Perovskite based solar cells offer a more cost effective and sustainable alternative to silicon, but are less robust chemically and mechanically. The addition of an organic layer in between sheets of metal-halide layers creates a 2D perovskite structure which have been shown to be more robust than traditional 3D perovskites, but typically less efficient.

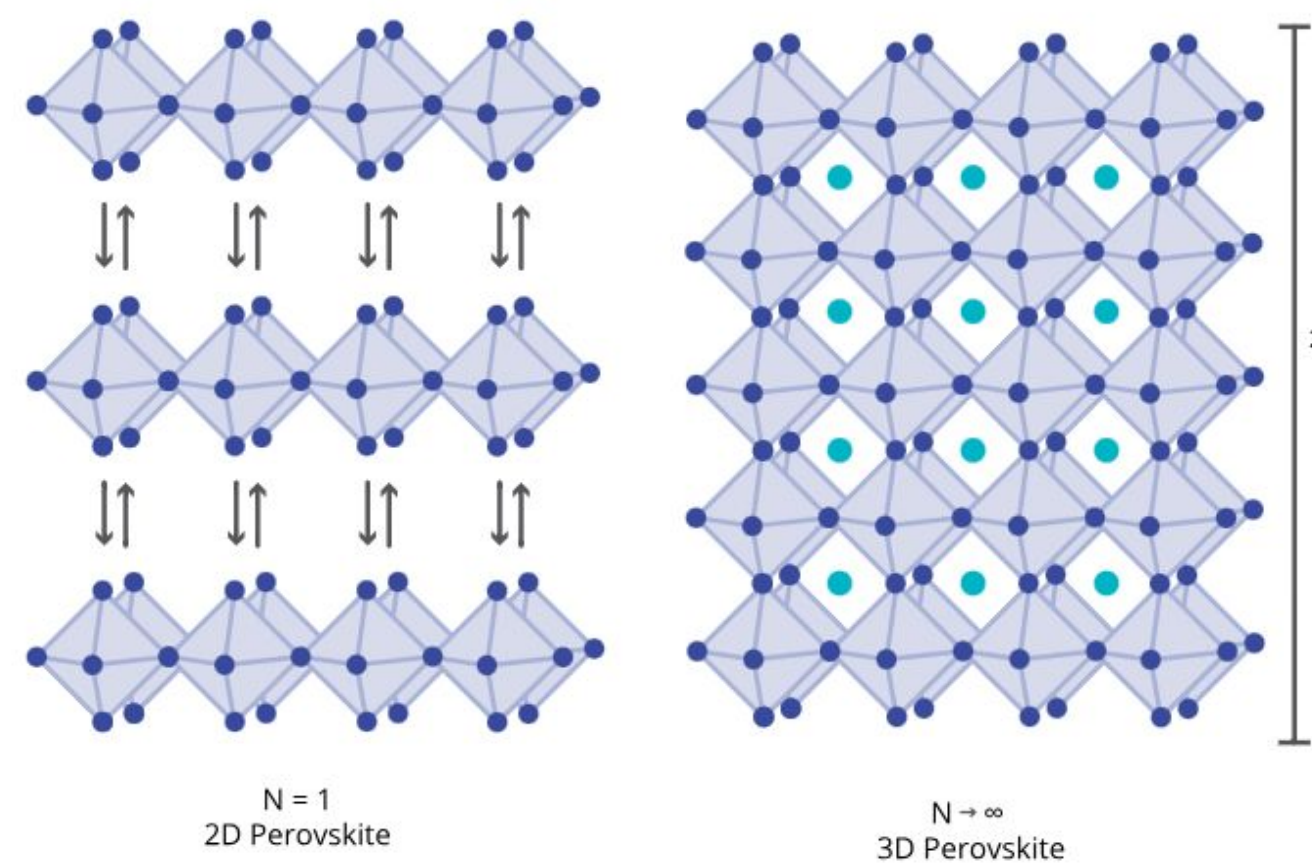


Fig. 1:  
2D and 3D  
perovskite  
crystal  
structures (1)

This project seeks to combine the sunlight absorption and environmental stability of 2D perovskites with the efficiency of 3D perovskites using 2D/3D layering. This change will be measured using prolonged heat and light exposure and fracture testing.

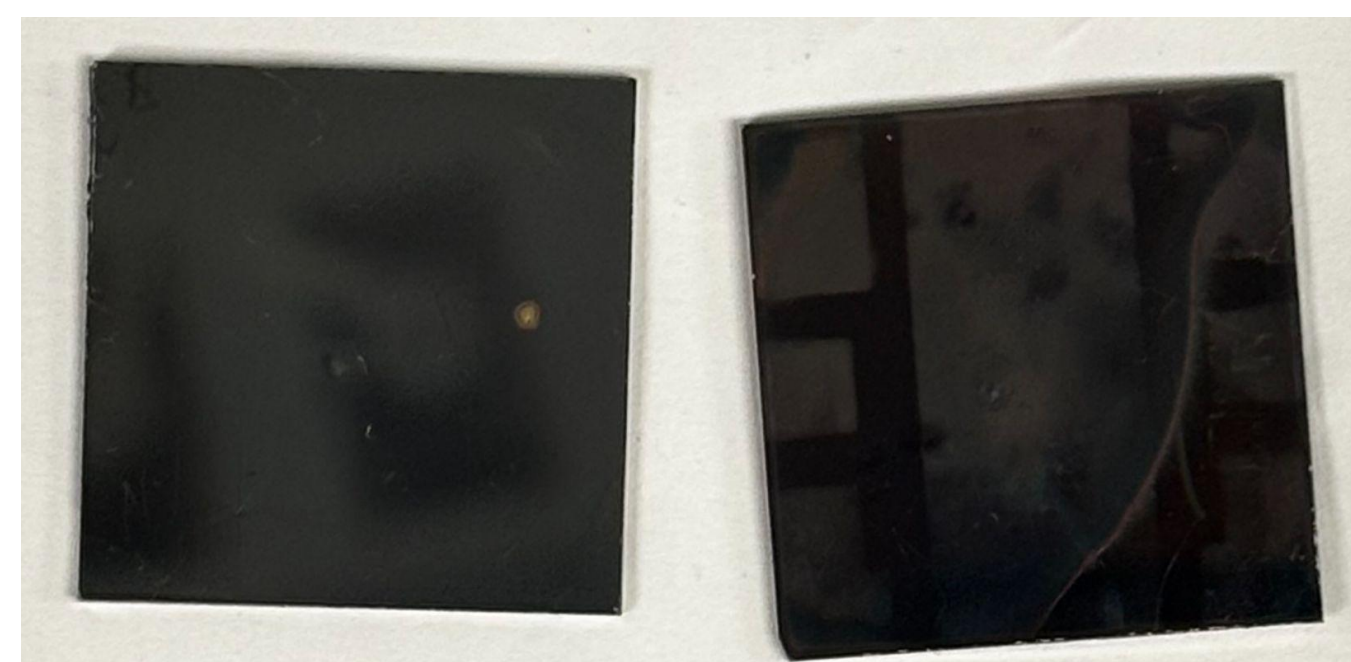
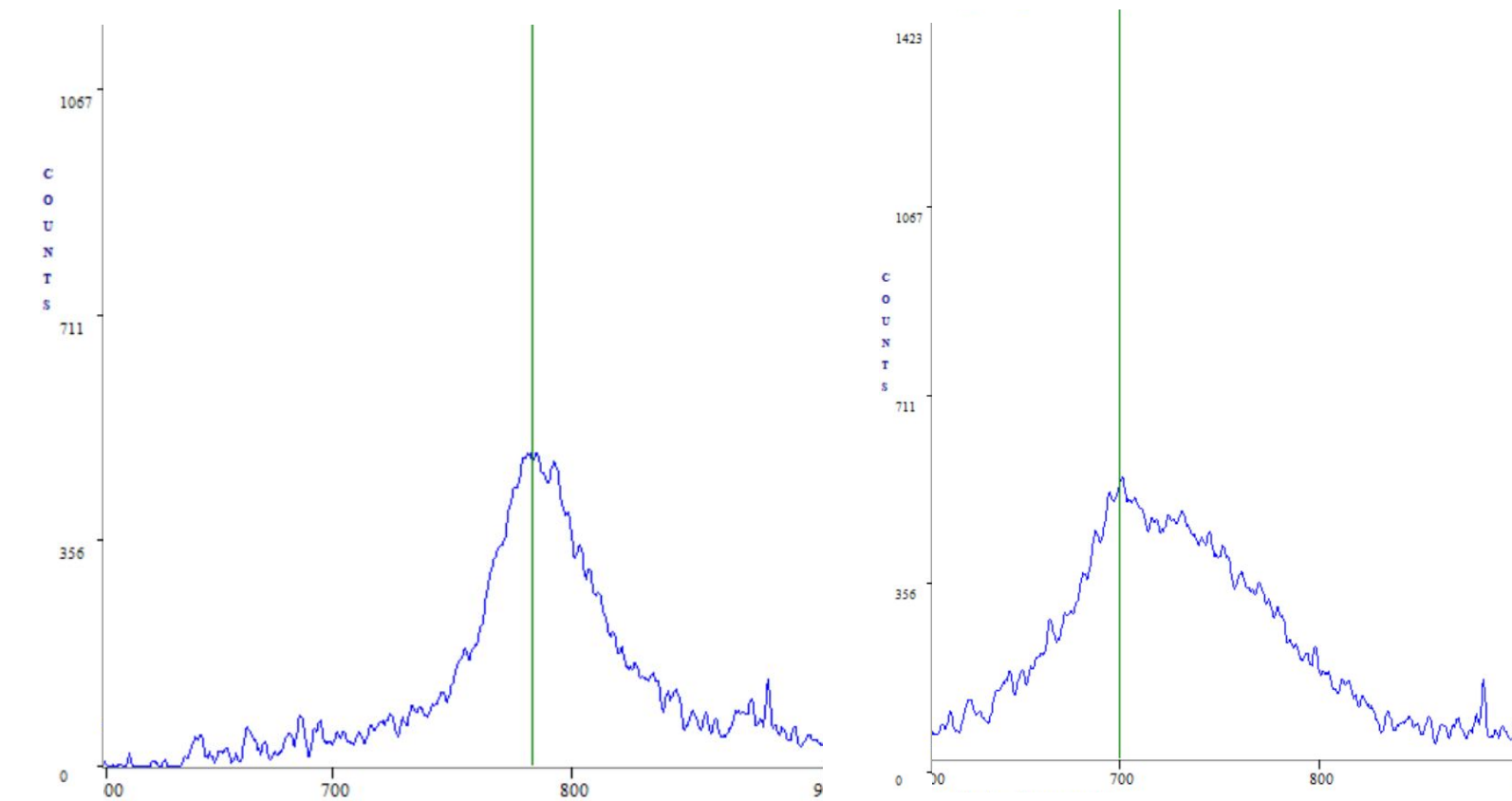


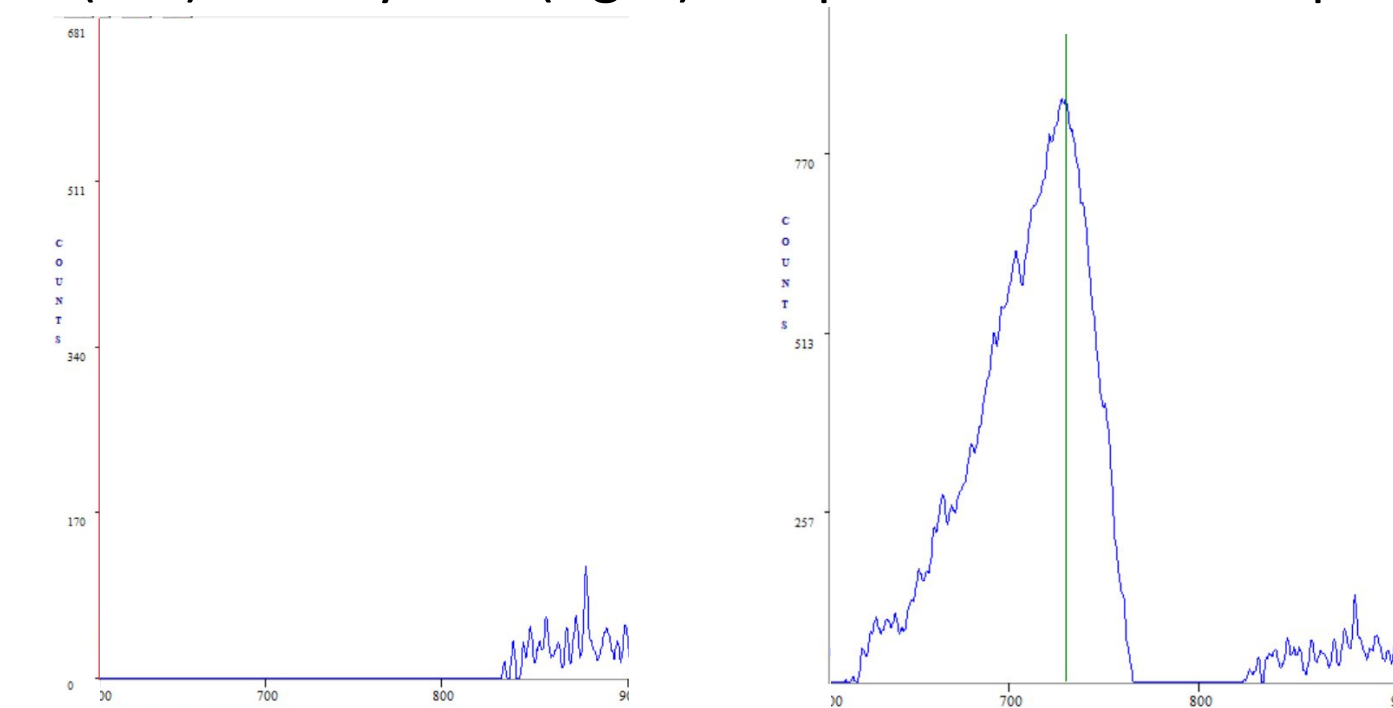
Fig. 2:  
3D (left) and layered  
(right) samples

## Process

Four glass slides were cleaned and then deposited with a perovskite ink. The 1.4 M ink was comprised of  $\text{Cs}_{0.2}\text{Fa}_{0.8}\text{PbI}_3$  in a 1:6.5 NMP:DMF solution. The samples were spin coated and annealed at 125 C for 30 minutes. Half of the samples were dynamically spin coated with PEAI in IPA then annealed at 125 for 10 minutes. One set of samples was placed on a hot plate at 85 C for 25 hours while the second set were subjected to light exposure for 100 hours.



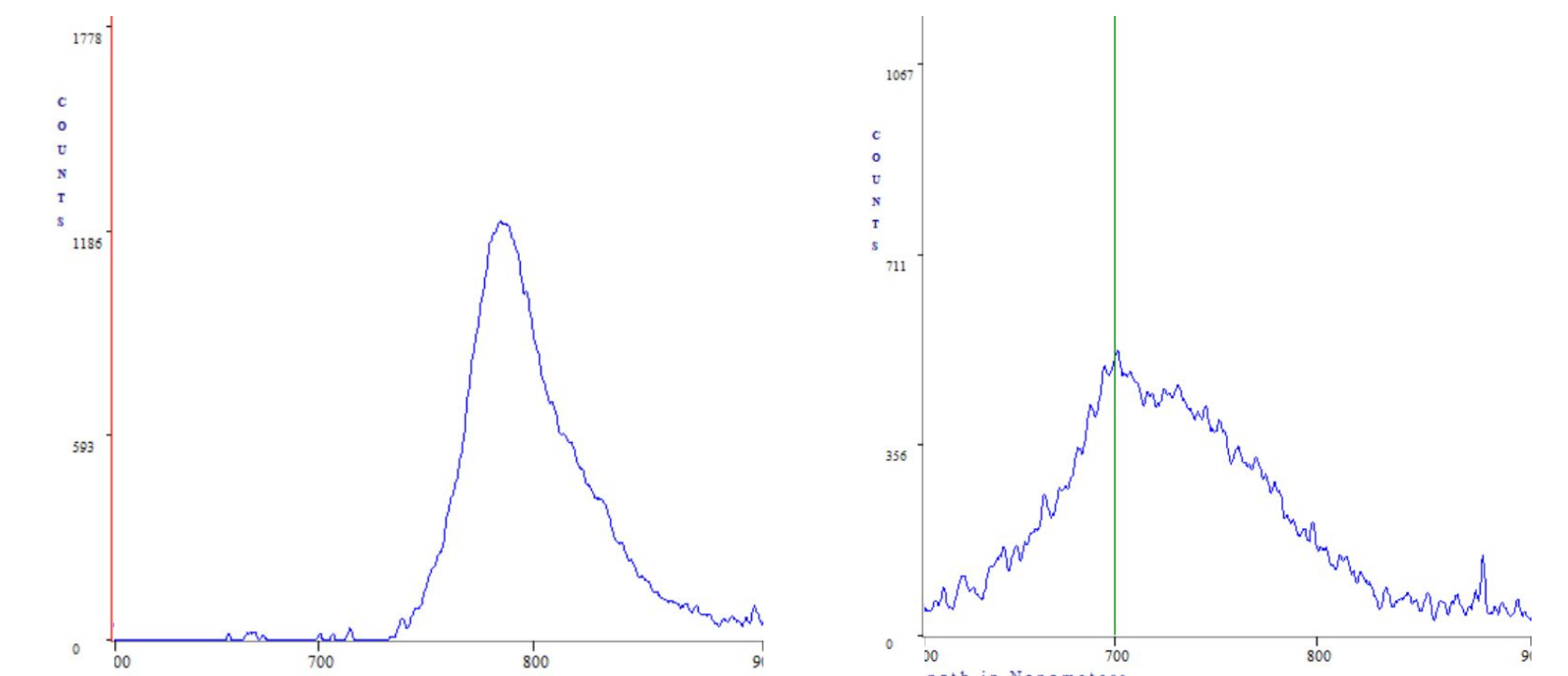
Figs. 3/4: 3D (left) and layered (right) samples before heat exposure



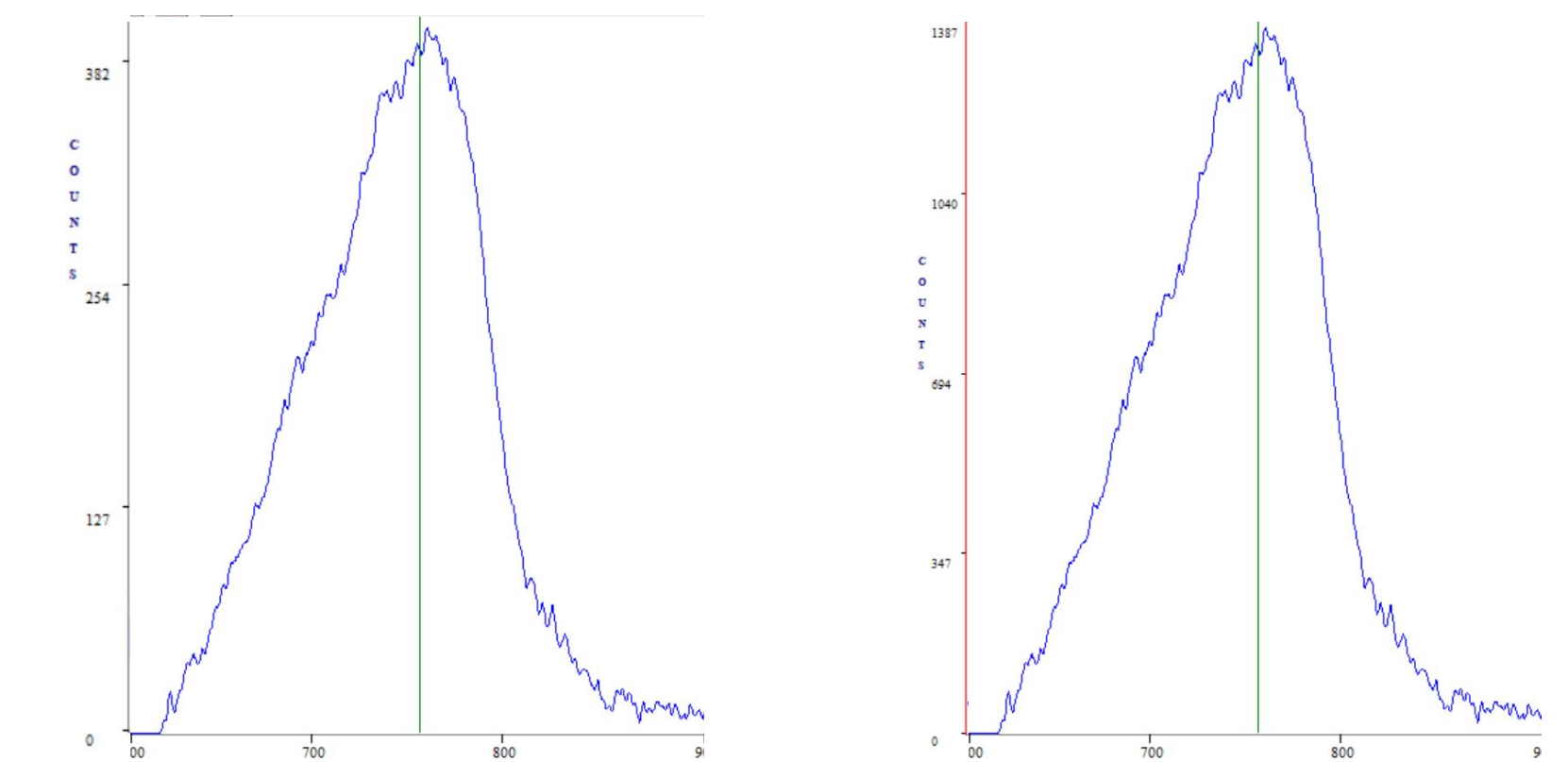
Figs. 5/6: 3D (left) and layered (right) samples after 25hr heat exposure

## Results

- Combined 2D/3D samples formed a hybrid wavelength absorption range at around 700nm (1.8 eV)
- Both prolonged heat and light exposure show the layered samples being more resistant to both heat and light from the environment.



Figs. 7/8: 3D (left) and layered (right) samples before light exposure



Figs. 9/10: 3D (left) and layered (right) samples after 100hr light exposure

## Future Work

- Experiment with additives such as PMMA to increase mechanical and chemical stability