

Large-Grained and High Charge-Carrier Lifetime $\text{CH}_3\text{NH}_3\text{PbI}_3$ Thin Films and Implications for Solar Cells (PV-3)



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Scientific Achievement:

- Simple vapor annealing process in methylamine ambient to get perovskite films with very large grain ($>15 \mu\text{m}$) and uniform coverage.
- High charge-carrier recombination lifetime in perovskite thin films measured by microwave-detected photoconductivity.

Significance and Impact:

- Recombination lifetime in perovskite film decreases as grain size increases.
- Simple and scalable method to attain large-grained perovskite film with enhanced stability in ambient as compared to as-deposited thin film.

Research Details:

- Demonstrated that methylamine vapor annealing process consistently leads to high-quality perovskite thin films with an average grain size of $10\text{--}15 \mu\text{m}$.
- Microwave-detected photoconductivity measurements show a charge-carrier lifetime of as high as $54 \mu\text{s}$ in large-grain thin films as compared to $21 \mu\text{s}$ in as-deposited thin films.

Publication(s):

A.S. Chouhan, J.N. Prathibha, S. Hadke, S. Raghavan, and S. Avasthi. Large grained and high charge carrier lifetime $\text{CH}_3\text{NH}_3\text{PbI}_3$ thin-films and implications for solar cells. *Current Applied Physics* 17,10 (2017). DOI: [10.1016/j.cap.2017.07.005](https://doi.org/10.1016/j.cap.2017.07.005)

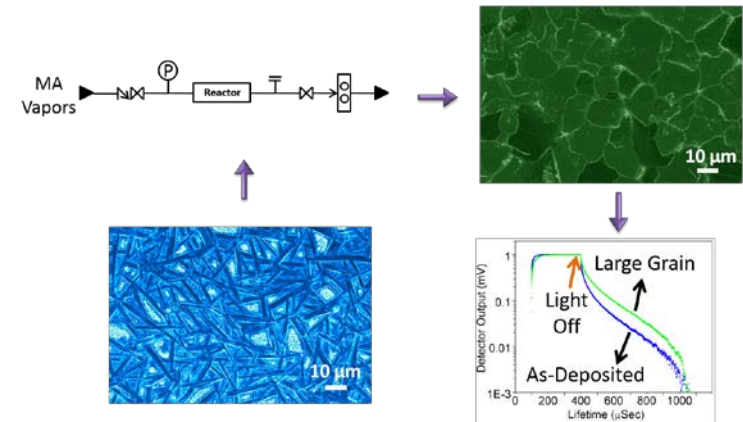


Fig. 1: Methylamine annealing process for large-grain perovskite thin-film.

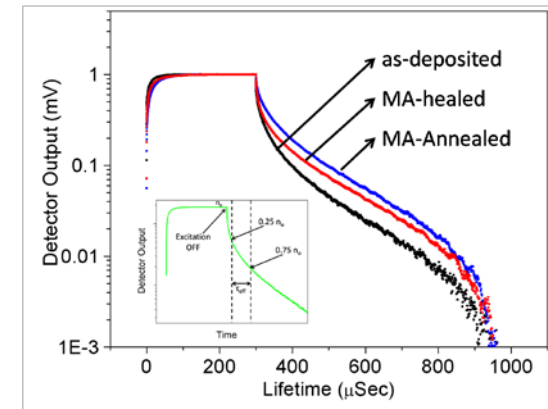


Fig. 2: Charge-carrier lifetime variation with perovskite thin-film morphology.

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