

Editor's note: This ESI for manuscript DOI: 10.1039/D0TC00328J was published on 7th August 2020, replacing an earlier document which had been uploaded in error that related to a different study.

Supporting Information

Resolving in-plane and out-of-plane mobility using time resolved microwave conductivity

*Shirsopratim Chattopadhyay,^a Robert S. Kokenyesi,^a Min Ji Hong,^a C Lowell Watts,^a John G. Labram^{*a}*

^aSchool of Electrical Engineering and Computer Science, Oregon State University, Corvallis, Oregon 97331, USA

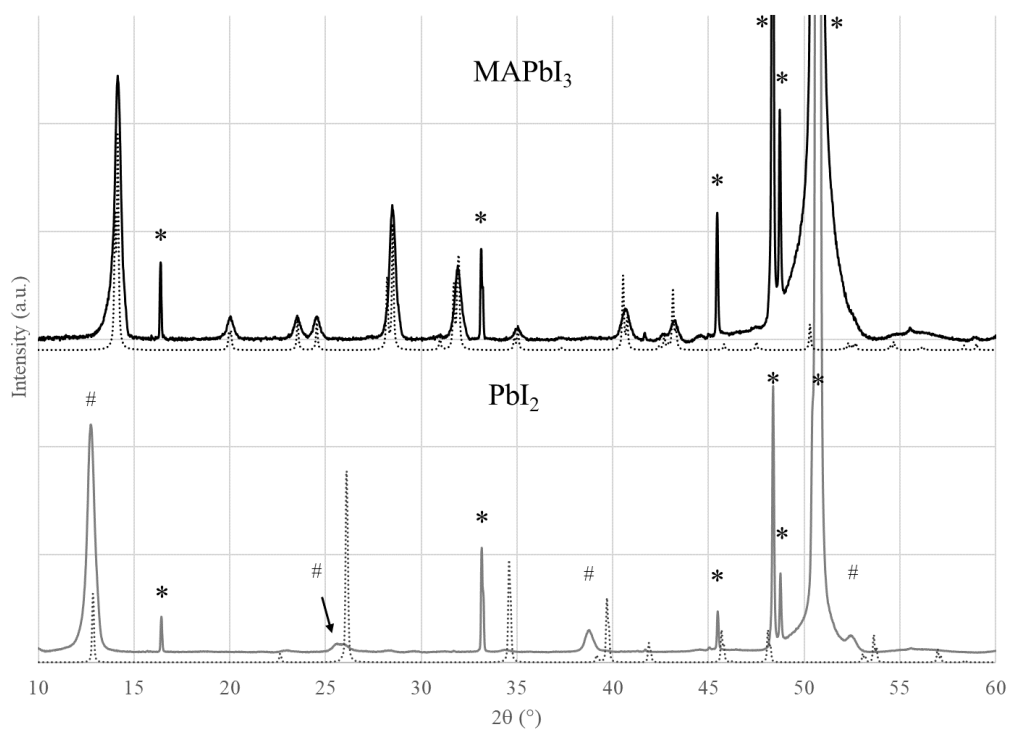
Corresponding Author

*Email: john.labram@oregonstate.edu

Table of Contents

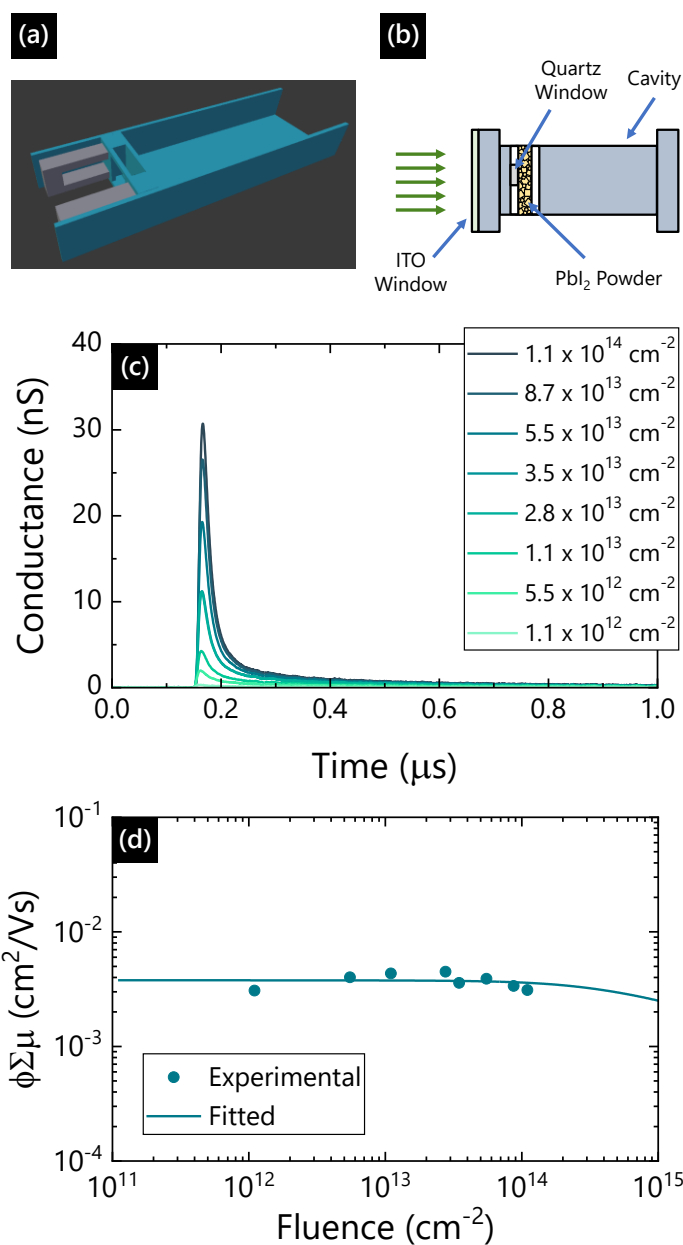
S1. X Ray Diffraction	2
S2. Time Resolved Microwave Conductivity of Lead Iodide Powder	3
Supplementary References.....	4

S1. X Ray Diffraction Spectra



Supplementary Figure S1 X-Ray diffraction (XRD) spectra of methylammonium lead iodide (MAPbI₃) and lead iodide (PbI₂). MAPbI₃ pattern indicates polycrystalline sample. PbI₂ 00l peaks are marked by #, indicating strong 00l texturing. Presence of 011 peak near 26° indicates minor polycrystallinity. * - denotes substrate peaks. Dotted lines are reference patterns: PbI₂ – Inorganic Crystal Structure Database (ICSD) 77325, MAPbI₃ – Crystallography Open Database (COD) 4335638.^{1,2}

S2. Time Resolved Microwave Conductivity of Lead Iodide Powder



Supplementary Figure S2 (a) 3D model and (b) schematic diagram of sample holder designed for time resolved microwave conductivity (TRMC) measurements on powder samples. (c) Photo-induced conductance (ΔG) as a function of time for a powder of lead iodide (PbI₂). (d) TRMC figure of merit: $\phi\Sigma\mu = \phi(\mu_e + \mu_h)$, as a function of laser fluence for powder of PbI₂. Here ϕ is the fraction of electron-hole pairs generated per absorbed photon (between 0 and 1), μ_e is the average electron mobility and μ_h is the average hole mobility of carriers, over the illuminated sample area. The lines are fits to the experimental data of a model³ that accounts for bimolecular and Auger recombination during the finite duration of the laser pulse. All measurements were carried out at room temperature in air.

Supplementary References

- ¹ K. Persson, *Materials Data on PbI_2 (SG:166) by Materials Project*, LBNL Materials Project; Lawrence Berkeley National Lab. (LBNL), Berkeley, CA (United States), 2014. doi: 10.17188/1199050.
- ² Y. Yamada, T. Yamada, L. Q. Phuong, N. Maruyama, H. Nishimura, A. Wakamiya, Y. Murata and Y. Kanemitsu, *J. Am. Chem. Soc.*, 2015, **137**, 10456–10459.
- ³ J. G. Labram and M. L. Chabinyo, *J. Appl. Phys.*, 2017, **122**, 065501.