

Optical constants manipulation of formamidinium lead iodide perovskites: Ellipsometric and spectroscopic twiggung

Mohd Taukeer Khan,^a Muhammed P. U. Haris,^b Baraa Alhourri,^a Samrana Kazim,^{b,c,d} Shahzada Ahmad^{b,d}

^aDepartment of Physics, Faculty of Science, Islamic University of Madinah, Prince Naifbin Abdulaziz, Al Jamiah, Madinah 42351, Kingdom of Saudi Arabia

^bBCMaterials, Basque Center for Materials, Applications, and Nanostructures, UPV/EHU Science Park, 48940, Leioa, Spain

Email: shahzada.ahmad@bcmaterials.net

^cMaterials Physics Center, CSIC-UPV/EHU, Paseo Manuel de Lardizabal 5, 20018, Donostia - San Sebastian, Spain

^dIKERBASQUE, Basque Foundation for Science, Bilbao, 48009, Spain

S1. Fitting of Spectroscopic Ellipsometer data

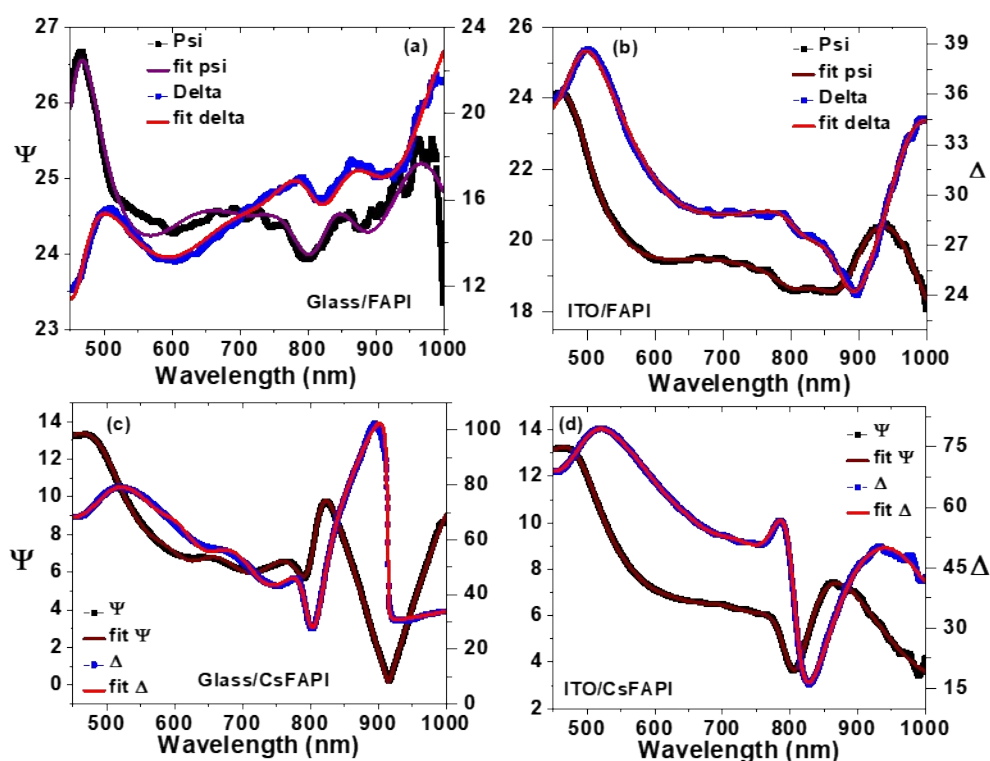


Figure S1. The measured amplitude ratio (ψ) and phase difference (Δ) of the FAPI and CsFAPI thin films on glass and ITO.

Table S1. Tauc-Lorentz fit parameters for FAPI and CsFAPI thin films on glass and ITO.

Sample	Glass/FAPI	ITO/FAPI	Glass/CsFAPI	ITO/ CsFAPI
r (nm)	15	23	21	15
Void (%)	20	23	12	9
ϵ_{∞}	1.25	1.24	1.10	1.01
A_1	3.43	30.55	24.53	6.16
E_1	1.55	1.45	1.57	1.58
C_1	0.19	0.44	0.13	0.13
A_2	44.45	52.101	7.60	6.52
E_2	2.18	2.18	2.46	2.45
C_2	4.35	3.70	0.49	0.54
A_3	0.83	1.00	6.50	8.26
E_3	2.70	2.45	3.31	3.18
C_3	0.41	0.49	3.89	0.61
χ^2	0.18	0.03	0.10	0.03

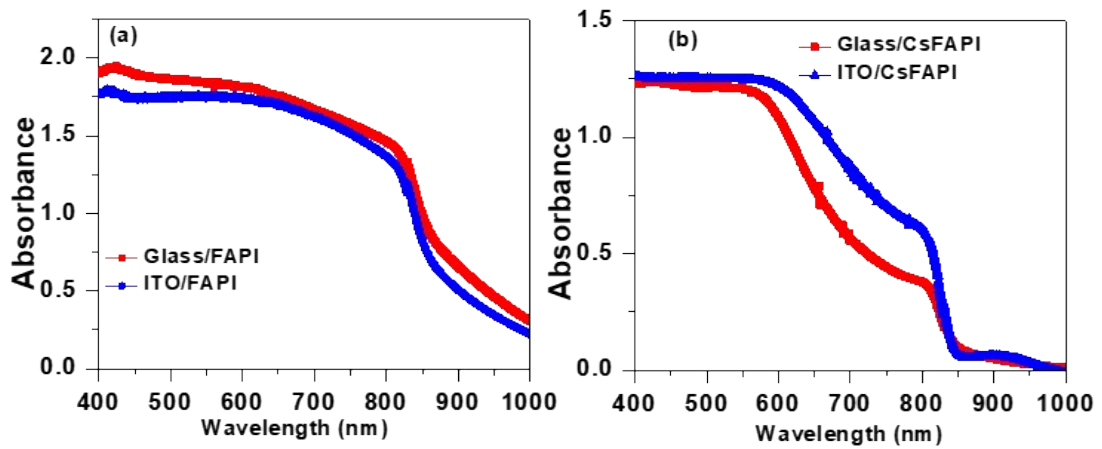


Figure S2. The absorption spectra of (a) FAPbI₃ and (b) CsFAPbI₃ thin films.

Table S2: Energy bandgap of FAPI and CsFAPI thin films on glass and ITO.

Sample	E_g
Glass/ FAPI	1.49 Ev
Glass/ITO/FAPI	1.50 eV
Glass/CsFAPI	1.59 eV
Glass/ITO/CsFAPI	1.58 eV

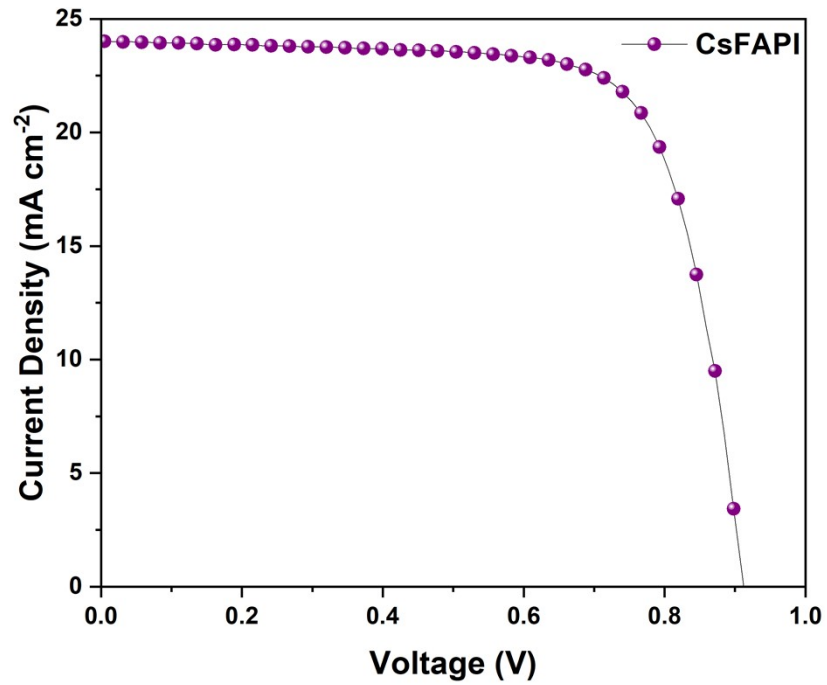


Figure S3. *J-V* characteristics under illumination of a typical CsFAPbI₃-based perovskites solar cell.

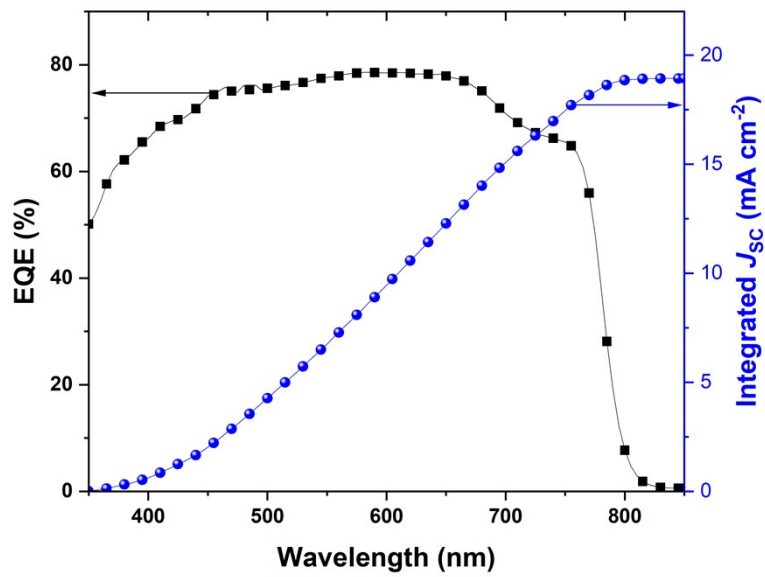


Figure S4. EQE characteristics of a typical CsFAPbI₃-based perovskites solar cell.