

Spray pyrolysis deposition of titanium dioxide

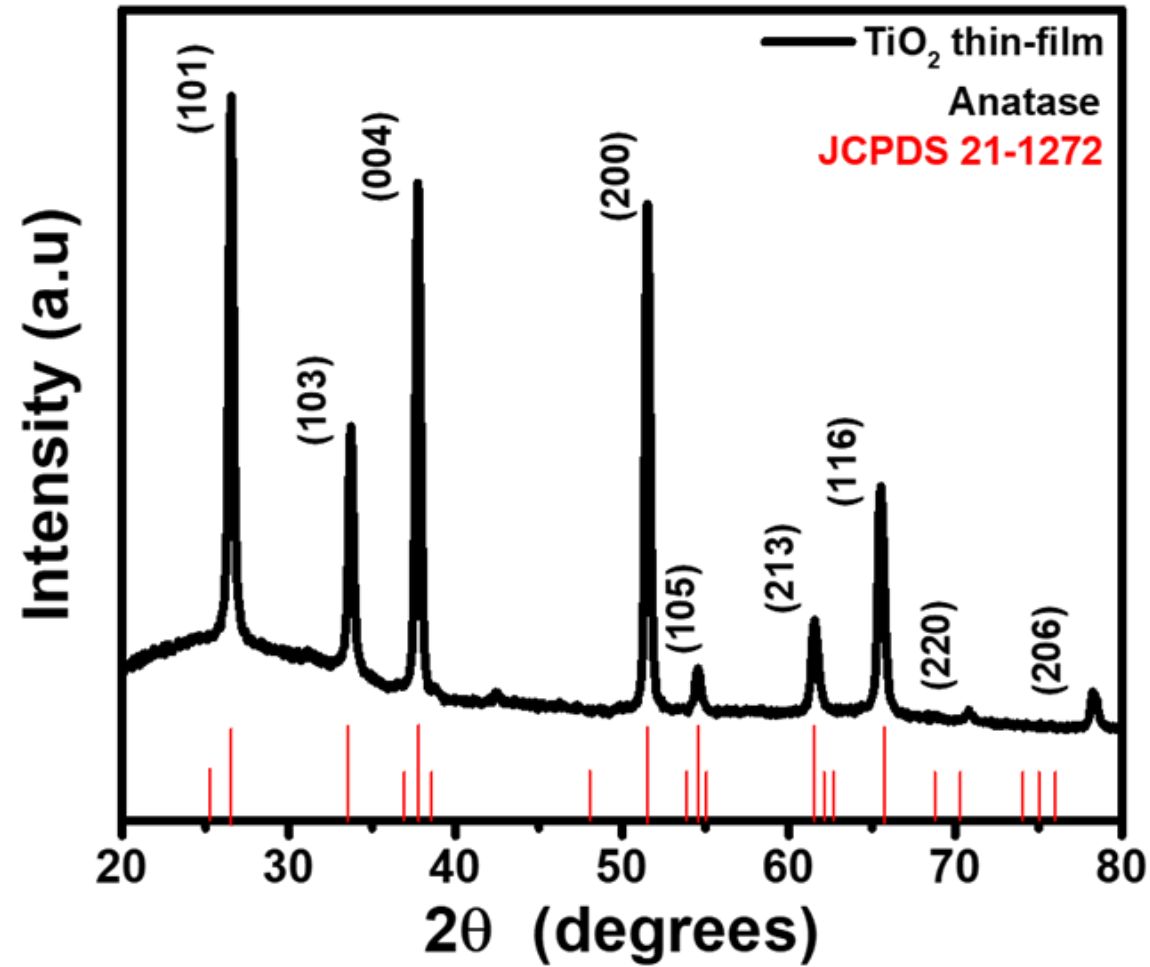
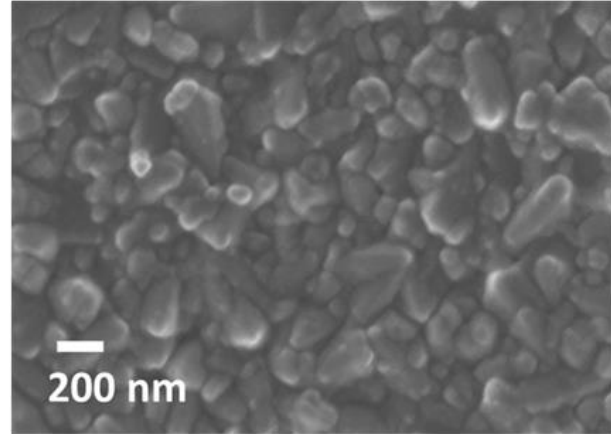
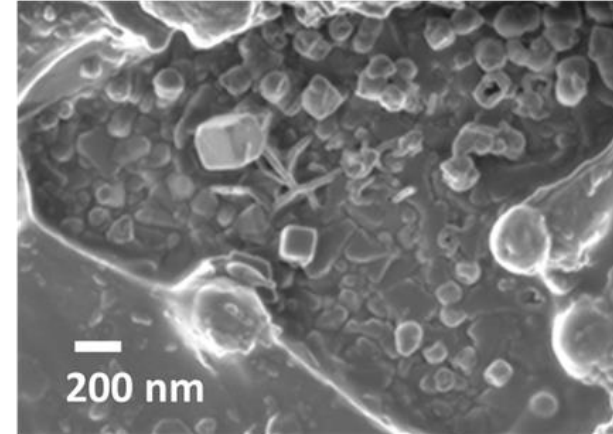


Figure 4.1: XRD pattern of c-TiO₂ thin film on FTO/glass substrate.

(a)



(b)



(c)

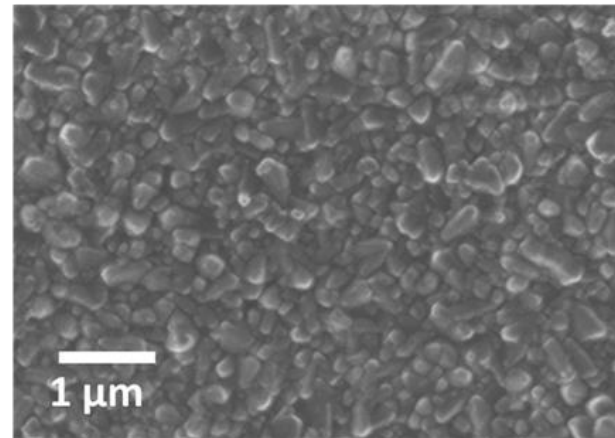


Figure 4.2: Top-view field-emission scanning electron microscopy (FE-SEM) images of TiO₂.

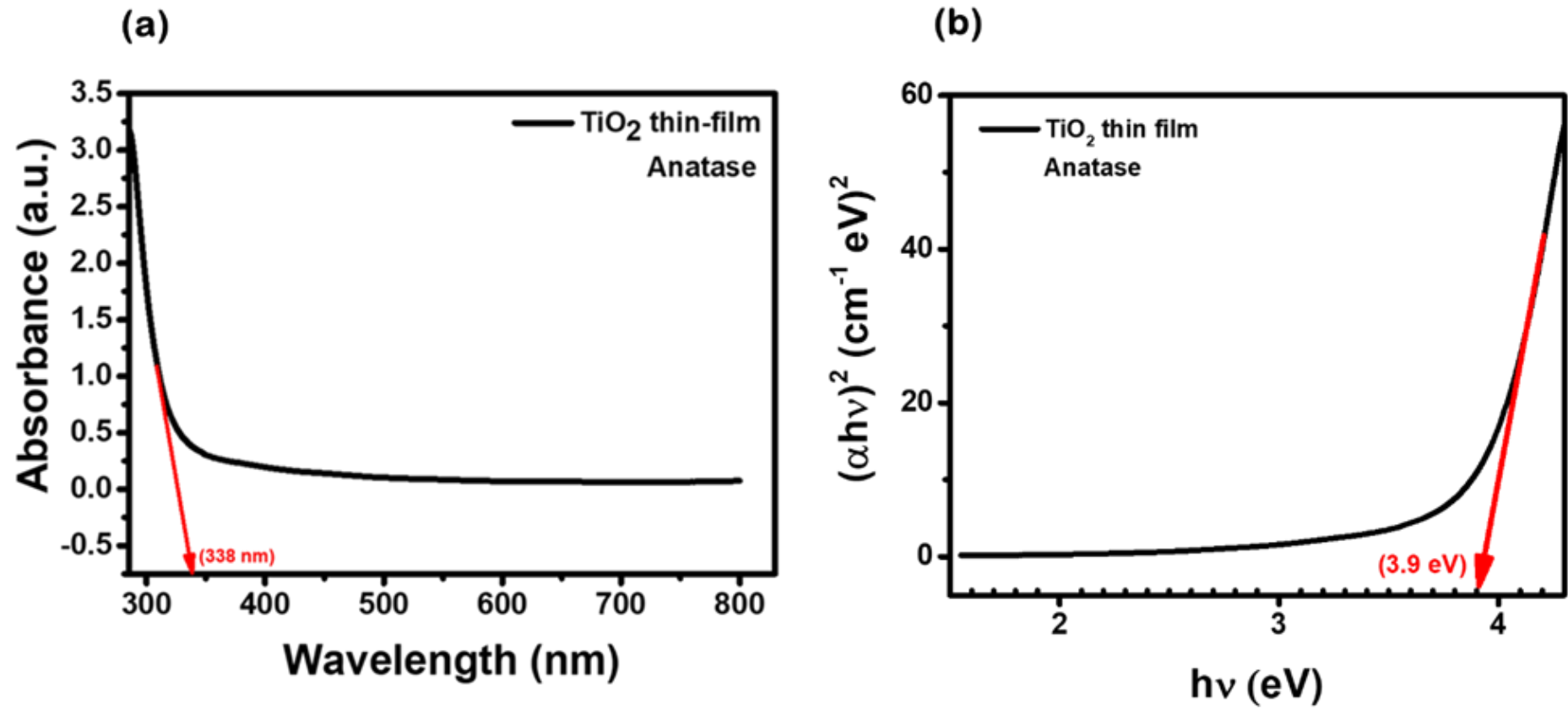


Figure 4.3: (a) Absorbance and, (b) Tauc plot for the bandgap estimation of TiO_2 thin film.

Sequential physical vapour deposition of caesium lead tri-iodide

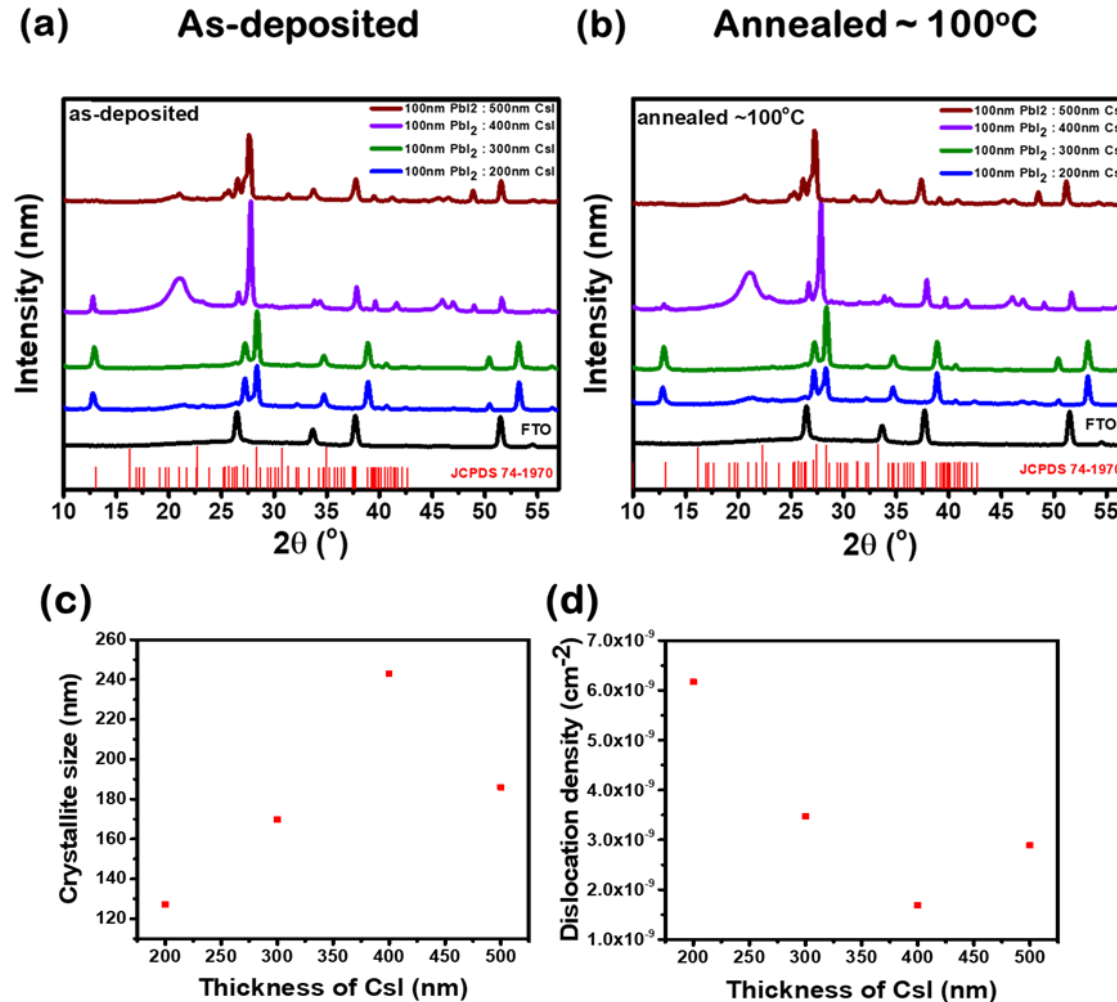
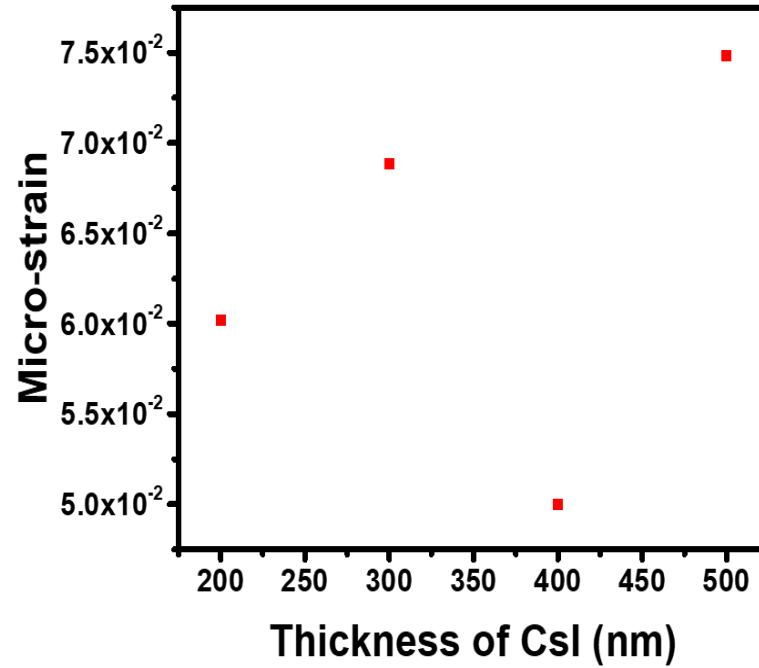


Figure 4.4: W-H plot ($\text{FWHM} \cos(\theta)$ vs. $4 \sin(\theta)$) of the CsPbI_3 diffractogram.

(a) CsI vs. Micro-strain



(b) CsI vs. Film thicknesses

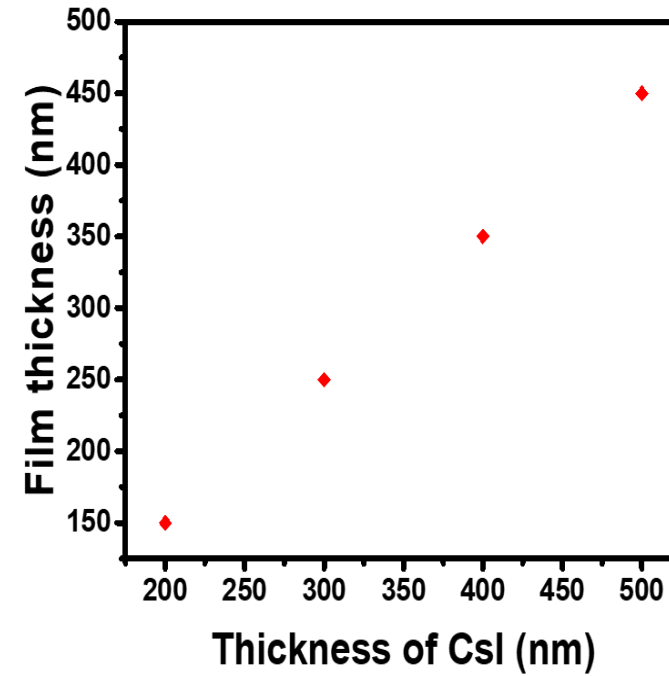


Figure 4.5: Illustration of (a) CsI vs. Micro-stain and (b) CsI vs. Film thickness.

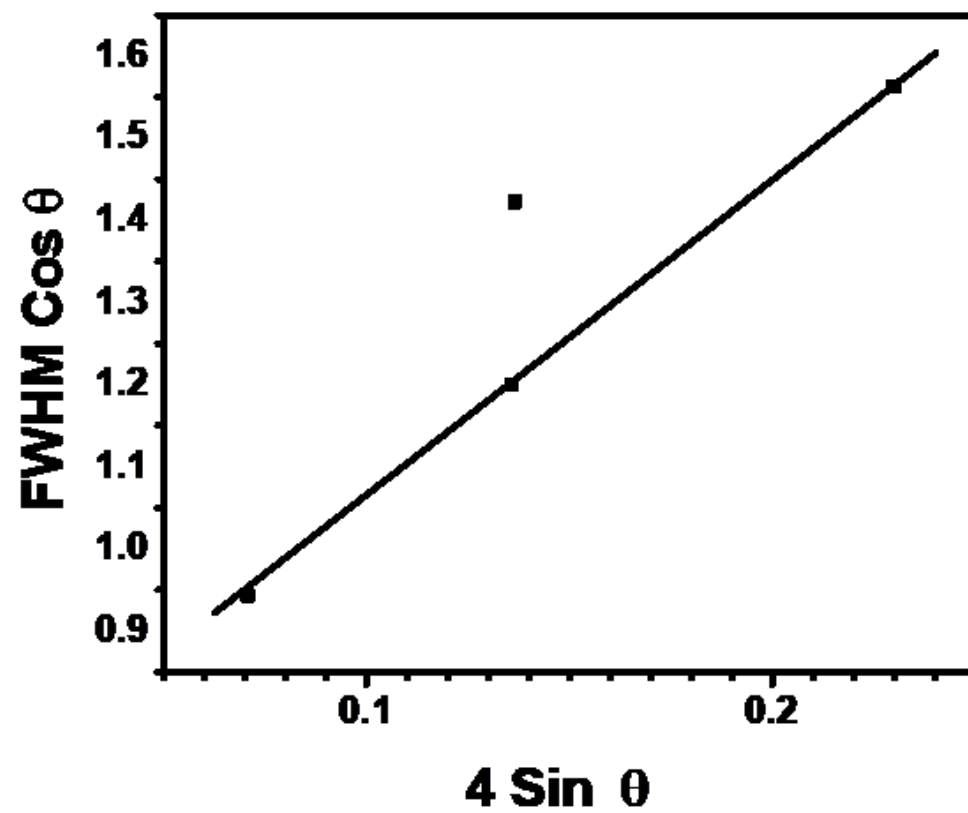
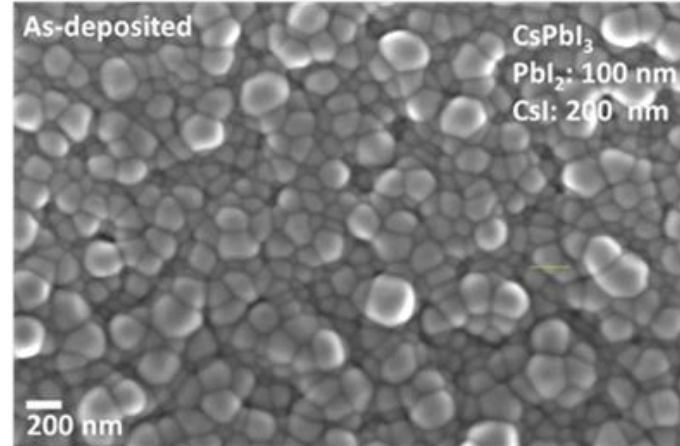


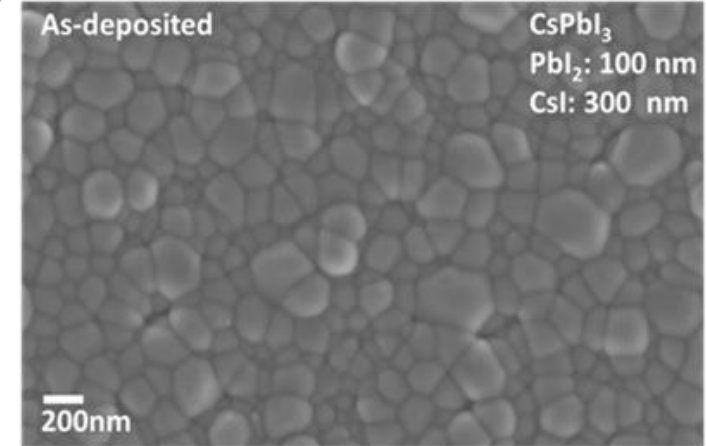
Figure 4.6: W-H plot ($FWHM \cos (\theta)$ vs. $4 \sin (\theta)$) of the $CsPbI_3$ thin film's diffractograms.

As-deposited

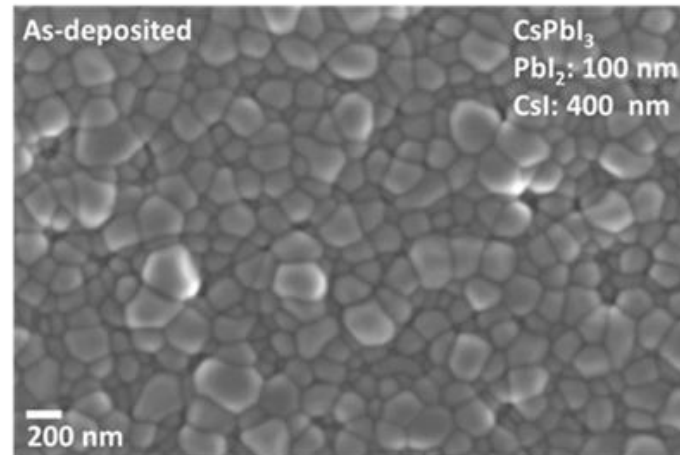
(a)



(b)



(c)



(d)

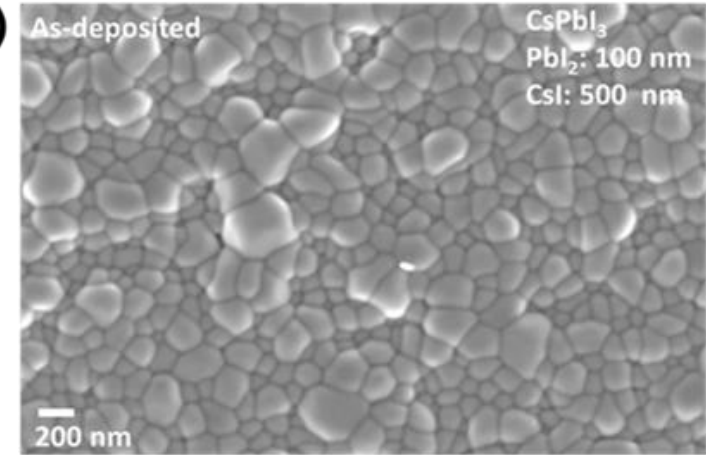


Figure 4.7: Top-view field-emission scanning electron microscopy (FE-SEM) images of CsPbI₃ layer with varying CsI thickness (a) 200 nm, (b) 300 nm, (c) 400 nm, and (d) 500 nm for as-deposited.

Annealed ~ 100°C

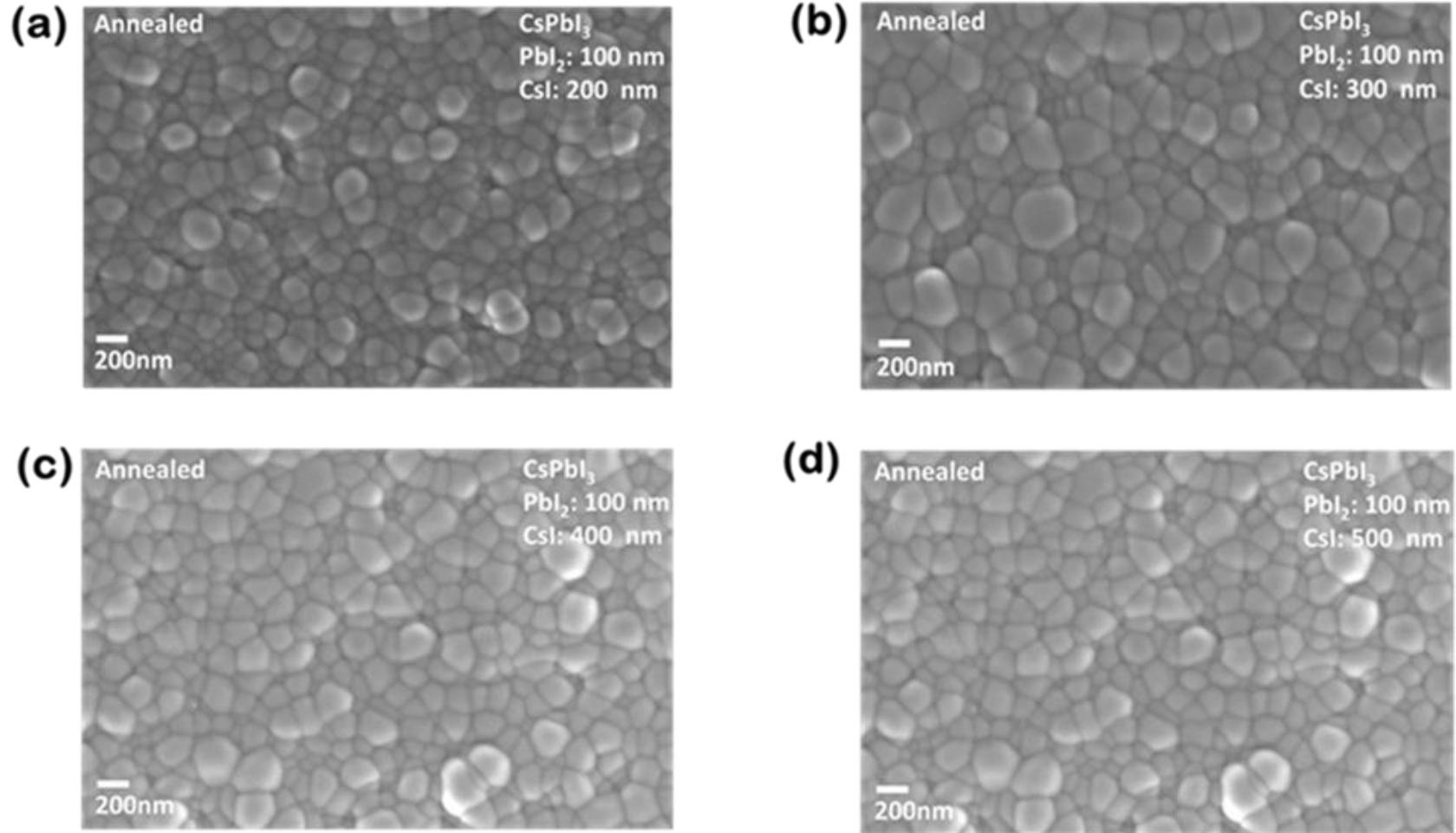


Figure 4.8: Top-view FE-SEM images of CsPbI_3 layer with varying CsI thickness (a) 200 nm, (b) 300 nm, (c) 400 nm, and (d) 500 nm for annealed (100 °C) samples.

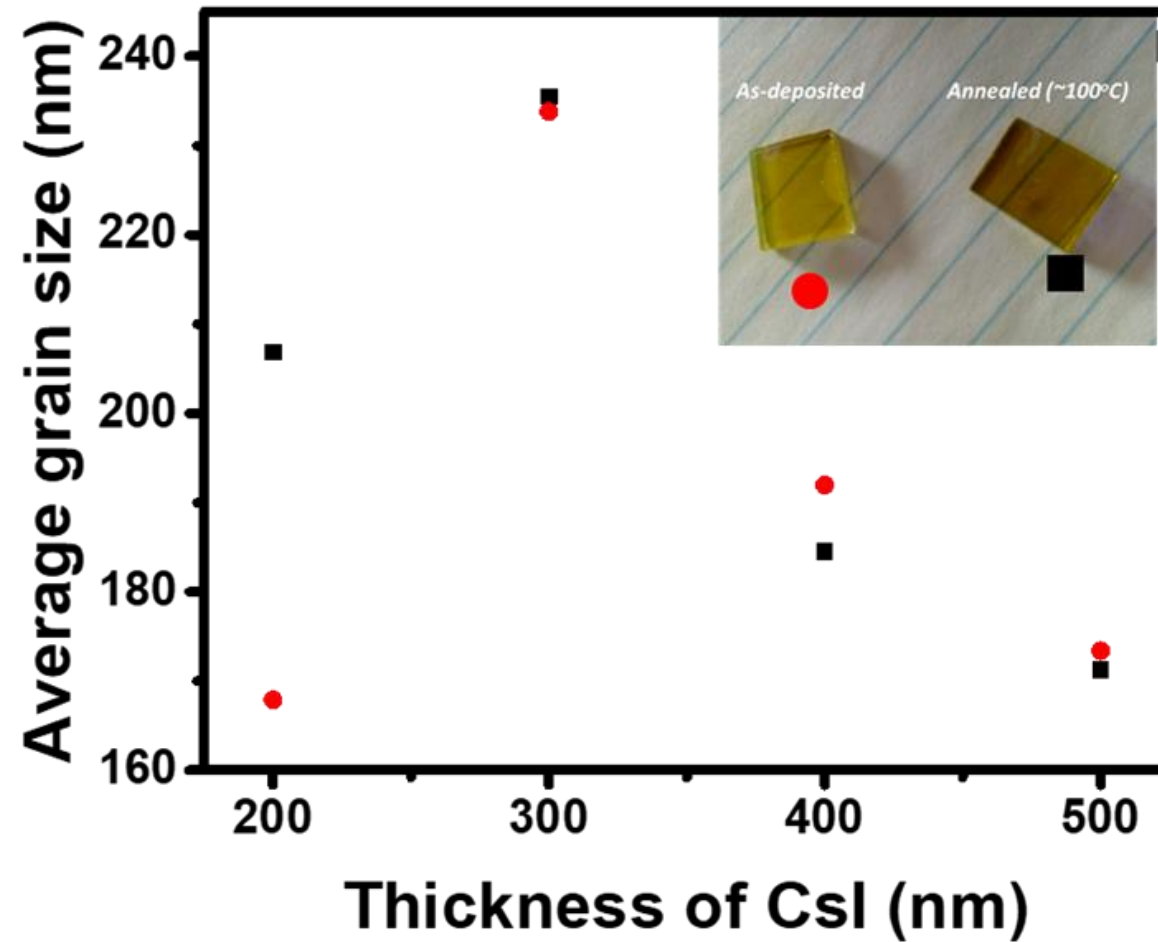


Figure 4.9: Distribution of CsPbI_3 average grain size (nm) with varying CsI thickness (from 200 nm – 400 nm) in steps of 100 for depicted as-deposited and annealed samples.

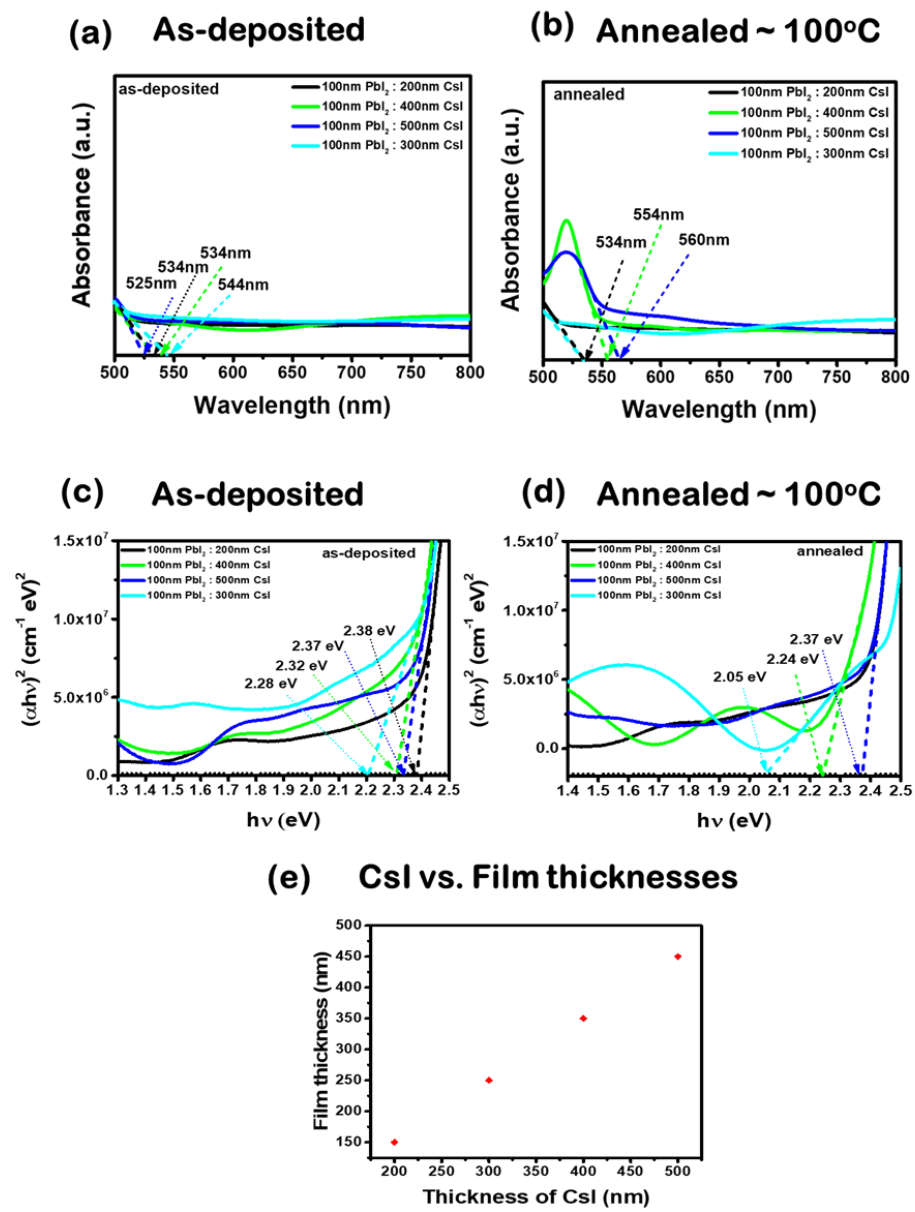


Figure 4.10: Absorbance's plots for (a) as-deposited (varying 200 nm – 500 nm CsI thickness), annealed 100 °C (varying 200 nm – 500 nm CsI thickness) the fabricated CsPbI₃ thin films. Tauc's plot for determining the bandgaps of CsPbI₃ layer deposited with different CsI thicknesses for (c) as-deposited (200 nm – 500 nm) and (d) annealed 100 °C (200 nm – 500 nm). (e) The film thickness of CsPbI₃ vs. Thickness of CsI.

Table Error! No text of specified style in document..1. Photovoltaic parameters of a light current-voltage (I-V) measurements for CsPbI₃ solar cells with different thicknesses CsI.

CsI Thickness (nm)	V _{oc} (V)	J _{sc} (mA/cm ⁻²)	R _{sh} (Ω/cm ⁻²)	R _s (Ω/cm ⁻²)	FF (%)	PCE (%)
200	0.96	17.29	91070.25	42496.66	26.85	4.49
300	0.27	20.40	15402.53	10294.93	28.05	1.53
400	0.88	10.89	888333.00	31718.28	41.98	4.04
500	0.75	18.66	107117.80	22691.65	36.24	4.93

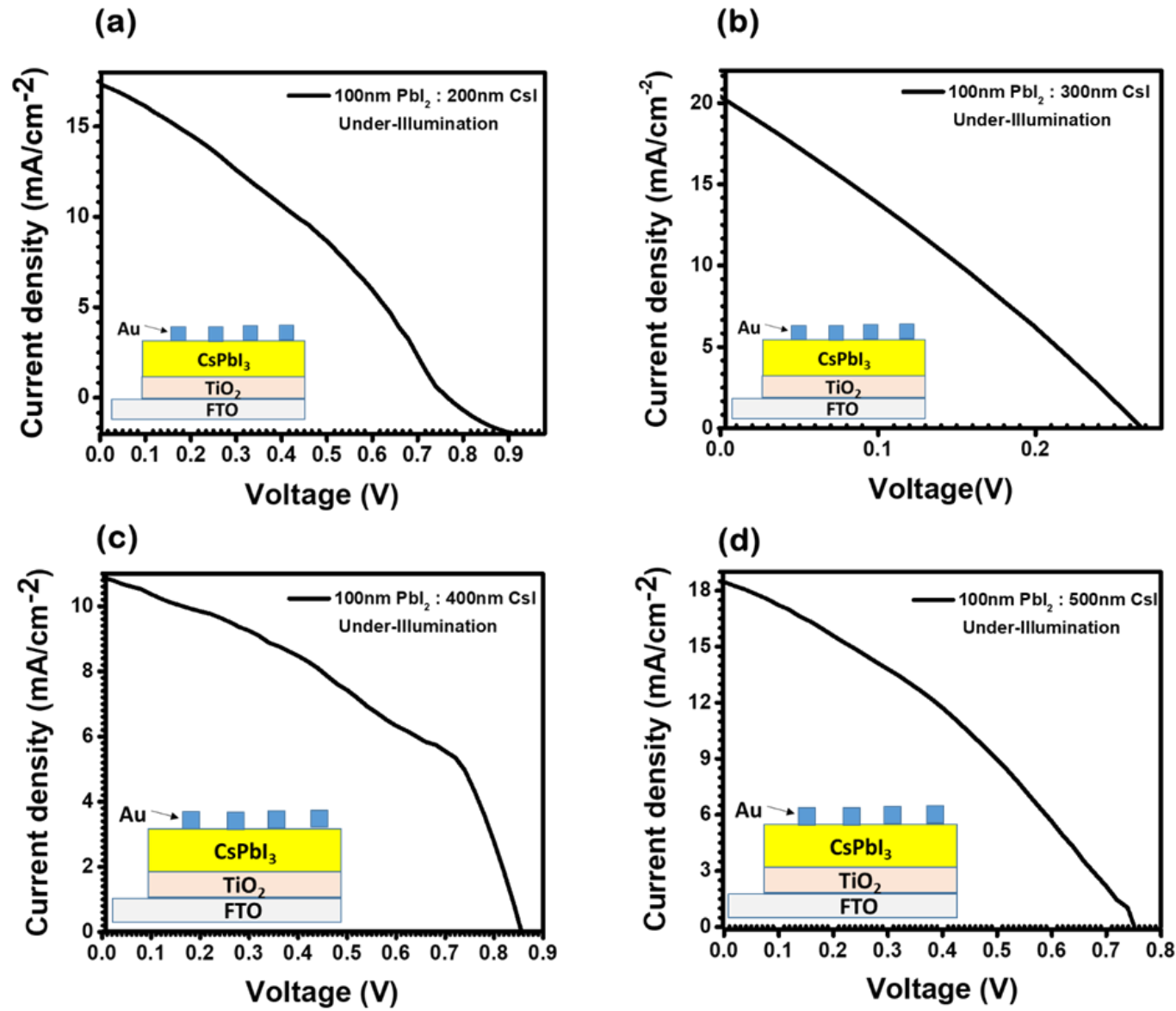


Figure 4.11: Electrical characterization of FTO/TiO₂/CsPbI₃/Au I-V characteristic at (a) 200nm CsI thickness, (b) 300nm CsI thickness, (c) 400nm CsI thickness, and (d) 500nm CsI thickness.