

Machine Learning Analysis of a 45% PM6 and 55% Y12 Device

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1 Individual Device Report

The device characterised here has been fabricated by Chen Wang. This device is of a PM6:Y12 active layer with 45% PM6 and 55% Y12.

2 Experimental Results

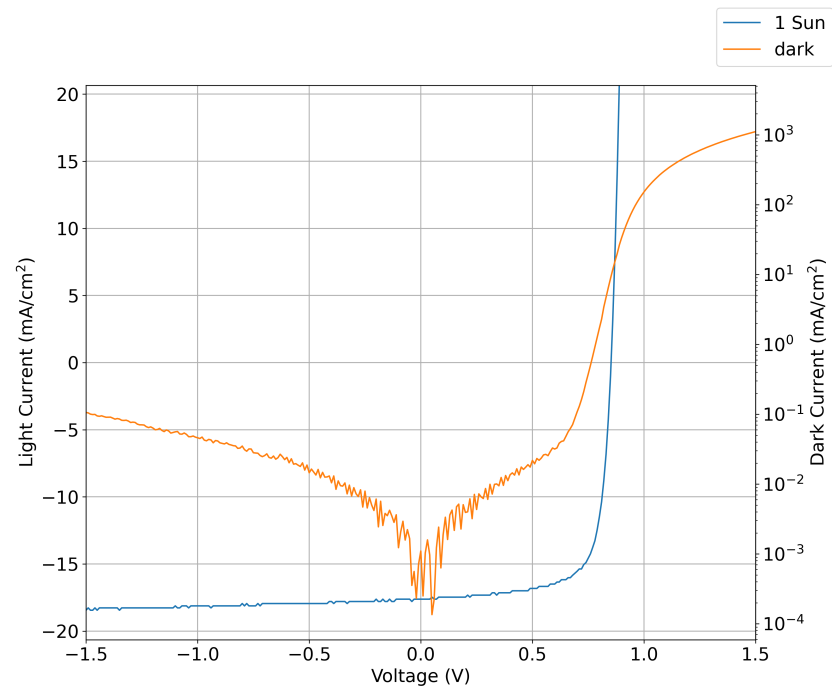


Figure 1: Experimental dark and light Current-Voltage characteristics

2.1 Calculated Paramaters

Paramater	Value	Unit
Voc	0.85	V
Jsc	-176.25	Am ⁻²
FF	0.74	<i>a.u</i>
PCE	11.07	<i>Percent</i>

2.2 Predicted Paramaters (Sanity Check)

Table 1: Calculable paramters predicted by Machine Learning

Output	Mean	Std	Unit	Matrix	MAPE (%)
V _{oc}	0.852	0.04	V	✓	2.630000
Fill factor	0.782	0.07	a.u.	✓	3.580000
Power conversion efficiency (PCE)	11.130	0.81	Percent	✓	19.900000
Max power	116.386	7.96	W m ⁻²	✓	21.900000
J _{sc}	-177.442	4.96	A m ⁻²	✓	67.200000

2.3 Futher Predicted Paramaters

Table 2: Predicted Mobility Parameters










Output	Mean	Std	Unit	Matrix	MAPE (%)
Average mobility at P_{max}	8.454×10^{-7}	6.374×10^{-10}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		5.350000
Average mobility at V_{oc}	2.427×10^{-6}	8.796×10^{-10}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		5.590000
Average mobility as J_{sc}	1.810×10^{-6}	1.637×10^{-9}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		7.480000
Electron mobility at P_{max}	3.187×10^{-5}	8.727×10^{-7}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		25.600000
Hole mobility y	3.846×10^{-6}	1.149×10^{-7}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		27.100000
Hole mobility at J_{sc}	1.184×10^{-6}	6.932×10^{-8}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		34.800000
Hole mobility at P_{max}	2.037×10^{-11}	5.084×10^{-4}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		36.900000
Electron mobility at J_{sc}	2.196×10^{-8}	3.750×10^{-8}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		40.600000
Electron mobility y	8.003×10^{-10}	4.898×10^{-6}	$\text{m}^2 \text{V}^{-1} \text{s}^{-1}$		149.000000

Table 3: Predicted Density of States Parameters









Output	Mean	Std	Unit	Matrix	MAPE (%)
Trapped electron to Free hole	1.026×10^{-20}	3.464×10^{-24}	m^{-2}		346.000000
Hole tail slope	0.086	0.00	eV		371.000000
Hole trap density	1.348×10^{22}	1.979×10^{19}	$\text{m}^{-3} \text{eV}^{-1}$		374.000000
Free hole to Trapped hole	2.497×10^{-24}	1.000×10^{-25}	m^{-2}		429.000000
Electron tail slope	0.077	0.04	eV		437.000000
Free electron to Trapped electron	3.089×10^{-23}	4.654×10^{-25}	m^{-2}		514.000000
Electron trap density	1.510×10^{21}	1.294×10^{20}	$\text{m}^{-3} \text{eV}^{-1}$		521.000000
Trapped hole to Free electron	3.122×10^{-23}	2.110×10^{-25}	m^{-2}		1500.000000

Table 4: Predicted Open Circuit Voltage Parameters








Output	Mean	Std	Unit	Matrix	MAPE (%)
Free holes at V_{oc}	1.409×10^{23}	2.922×10^{20}	m^{-3}		6.660000
Free electrons at V_{oc}	6.051×10^{22}	4.826×10^{19}	m^{-3}		6.870000
Recombination time constant at V_{oc}	9.659×10^{-5}	1.742×10^{-8}	s^{-1}		12.400000
Recombination rate at V_{oc}	4.304×10^{25}	2.018×10^{24}	$\text{m}^{-3} \text{s}^{-1}$		23.900000
Trapped holes at V_{oc}	4.040×10^{18}	4.902×10^{11}	m^{-3}		25.800000
Total carriers $(n+p)/2$ at V_{oc}	1.991×10^{23}	3.006×10^{22}	au		26.800000
Trapped electrons at V_{oc}	2.250×10^{16}	1.092×10^{12}	m^{-3}		32.000000

Table 5: Predicted Maximum Power Point Parameters






Output	Mean	Std	Unit	Matrix	MAPE (%)
Voltage at max power	0.732	0.04	V		3.560000
Recombination Time Constant at P_{max}	3.266×10^{-4}	1.910×10^{-8}	s^{-1}		9.900000
Current density at max power	-160.996	7.16	Am^{-2}		12.900000

Table 6: Misc Predicted Parameters

Output	Mean	Std	Unit	Matrix	MAPE (%)
Shunt resistance	2.334	0.01	Ohms m^2		6.160000
Series resistance	5.594	3.93	Ohms		36.400000

3 Confusion Matrices

