

# OLED Model Development & Extraction For Leading-edge Display Panels

## Service Project:

Customer is developing the Organic Light Emitting Diode (OLED) devices for leading-edge display panels. But, they don't have an appropriate model for OLED that matches the measured current and luminance data, especially for the optical part. The goal of this project is to develop an OLED model and extract a set of parameters that best fit the available physical measurements. MSIM-OLED Model Extractor was used for this service project.

## Measured Data Provided:

The input data required for OLED model extraction are (1) number of layers and layer thickness of the device, (2) LUMO and HOMO of host material of each layer, (3) LUMO and HOMO of guest material of each layer, (4) electron and hole mobility of each layer, (5) measured current density, and (6) measured luminance.

The measurement data provided are the OLED current density, at various operating voltages. The luminance data are also given to build the L-V model of that OLED.

The example of OLED layer data is shown below

Types	HIL	HIL	HTL	EML	EML	ETL	EIL
Names	HI01	HI02	NPB	RH02	RD01	ET02	LIQ
Thickness	100	200	200	90	10	100	100
LUMO	6	1.8	2.4	2.7	3.4	3.1	3.24
HOMO	9.8	4.9	5.4	5.6	5.46	6.5	6.25
Electron Mobility	1e-5	1e-5	1e-5	8e-8	8e-8	8e-8	8e-8
Hole Mobility	1.8e-4	1.8e-4	1.8e-4	7e-10	7e-10	7e-10	7e-10

The format of current density and luminance data are like

Volt	J of Device A	J of Device B	L of Device A	L of Device B
2	0.00	0.00	0.00	0.00
3	0.2	0.2	25	25
4	2	2	200	200
5	6	6	700	700
6	15	15	1600	1600
7	30	30	3000	3000
8	50	50	5122	5000
9	80	80	7000	7000
10	120	110	110000	110000

## Model Extracted:

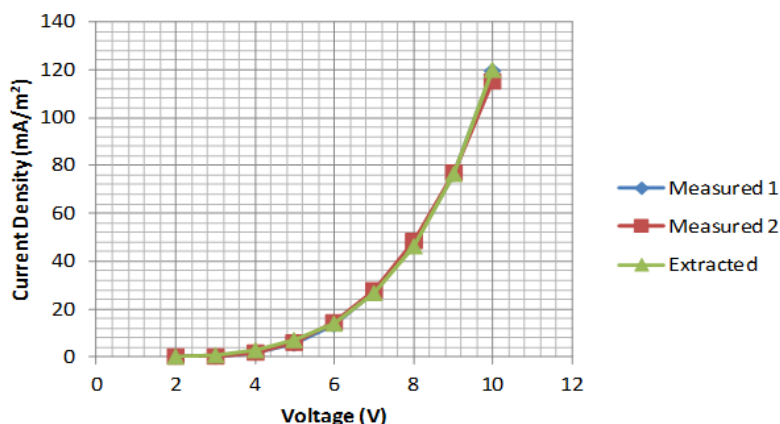


Fig. 1: Current Density versus Voltage operating in dark environment and room temperature.

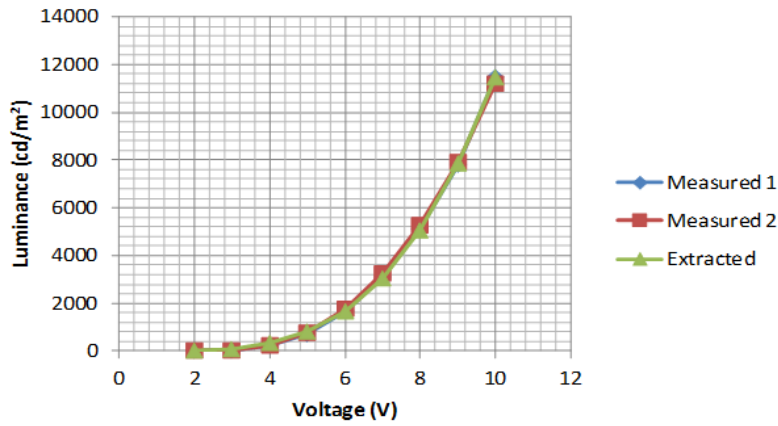


Fig. 2: Luminance versus Voltage operating in dark environment and room temperature.

### **Summary:**

The extracted J-V and L-V models fit the measured J-V and L-V data very well. The predicted J-V and L-V of ETL:100 are proven to be very close to the measured data. With merely 2 sets of measurement data, MSIM-OLED can produce a very accurate model for customer to perform process tuning and parameter optimization.