

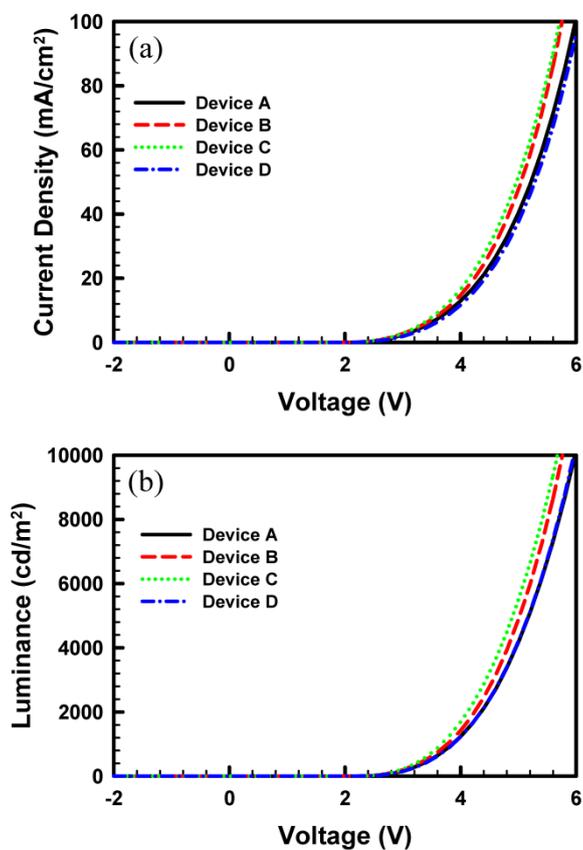
## Supporting Information for

### Improvement of lifetime for polymer light-emitting diode by introducing solution processed tungsten-oxide

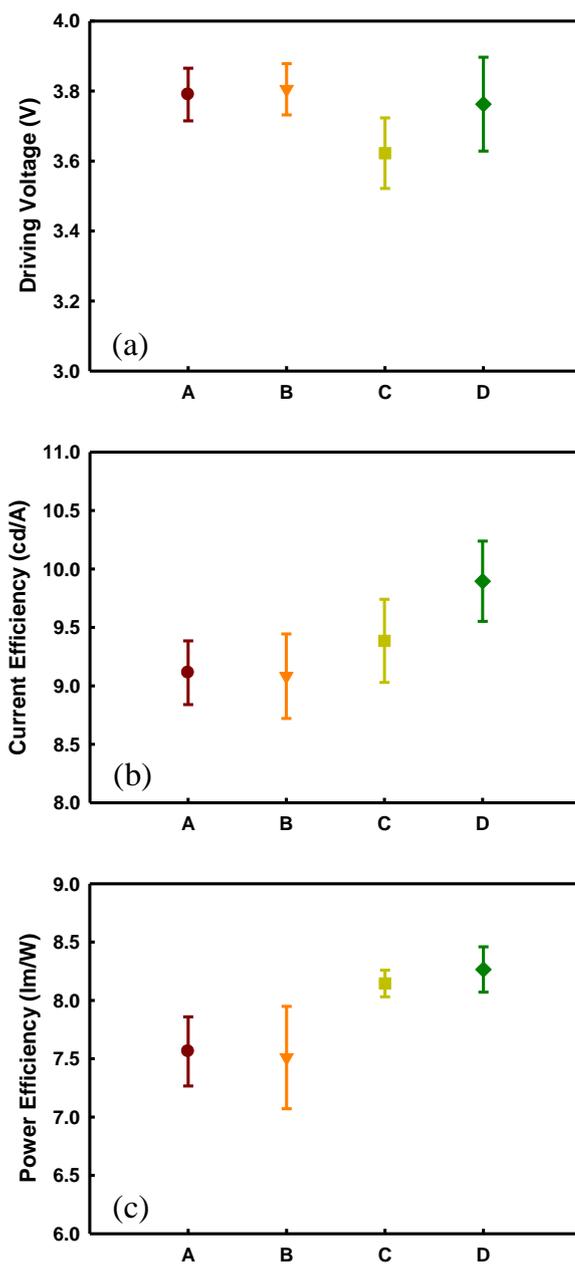
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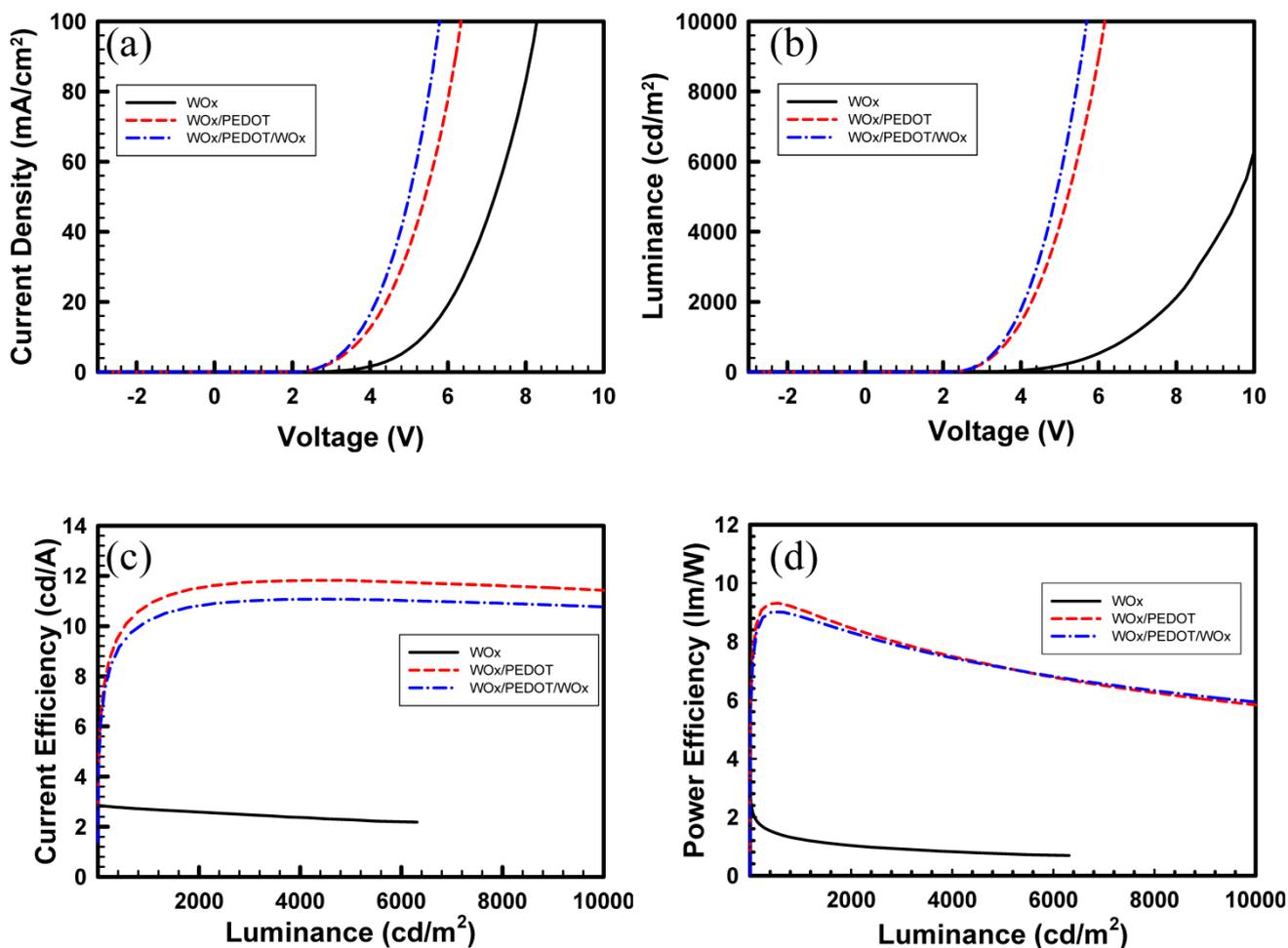
**Figure S1.** (a) Current density - voltage (J - V) and (b) luminance-voltage (L-V) characteristics of the devices: devices A (black solid line), B (red dash line), C (green dot line) and D (blue dash dot line).



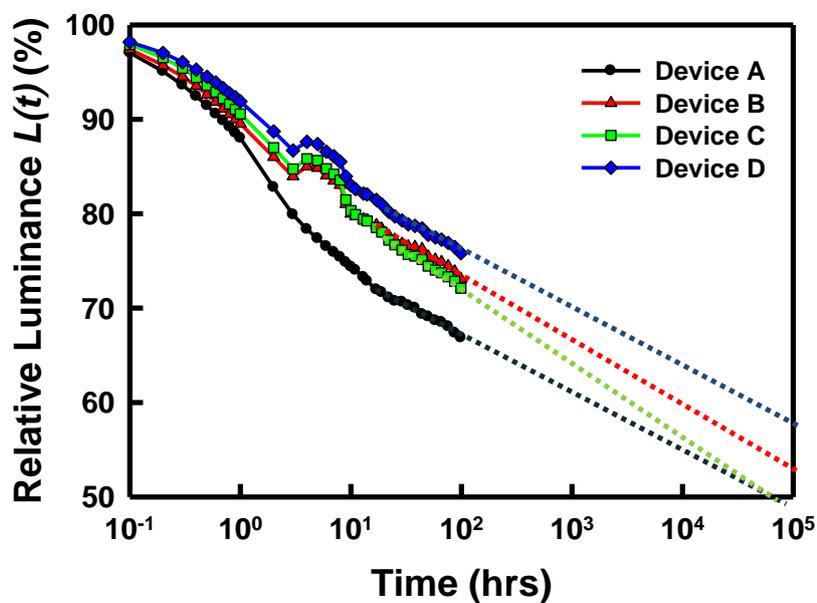
**Figure S2.** Average values of (a) driving voltage, (b) current efficiency and (c) power efficiency at  $1000 \text{ cd/m}^2$  with error bar.

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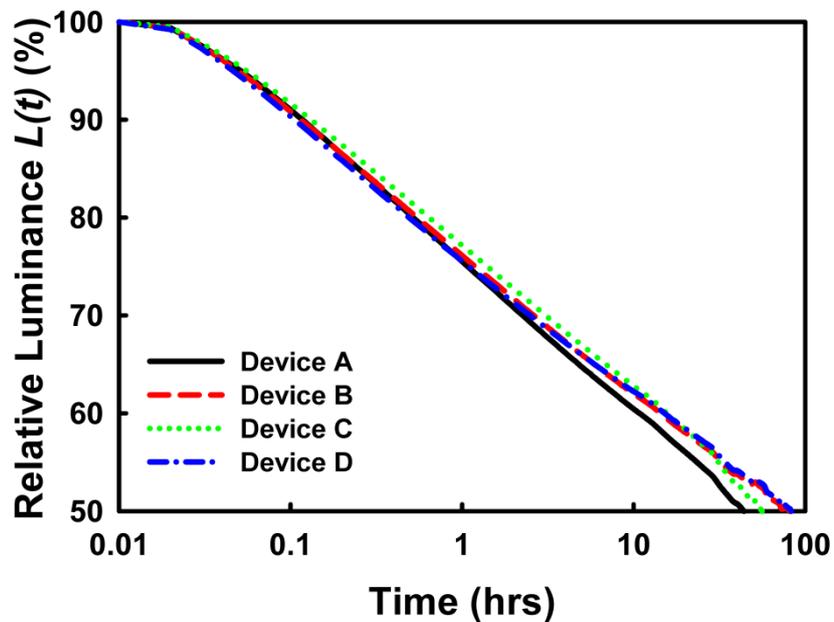


**Figure S3.** (a) Current density - voltage (J - V), (b) luminance-voltage (L-V), (c) current efficiency - luminance and (d) power efficiency - luminance characteristics of the devices: devices with WO<sub>x</sub> as only HIL material (black solid line), WO<sub>x</sub>/PEDOT:PSS as HIL (red dash line),  
5 WO<sub>x</sub>/PEDOTPSS/WO<sub>x</sub> as HIL (blue dash dot line).



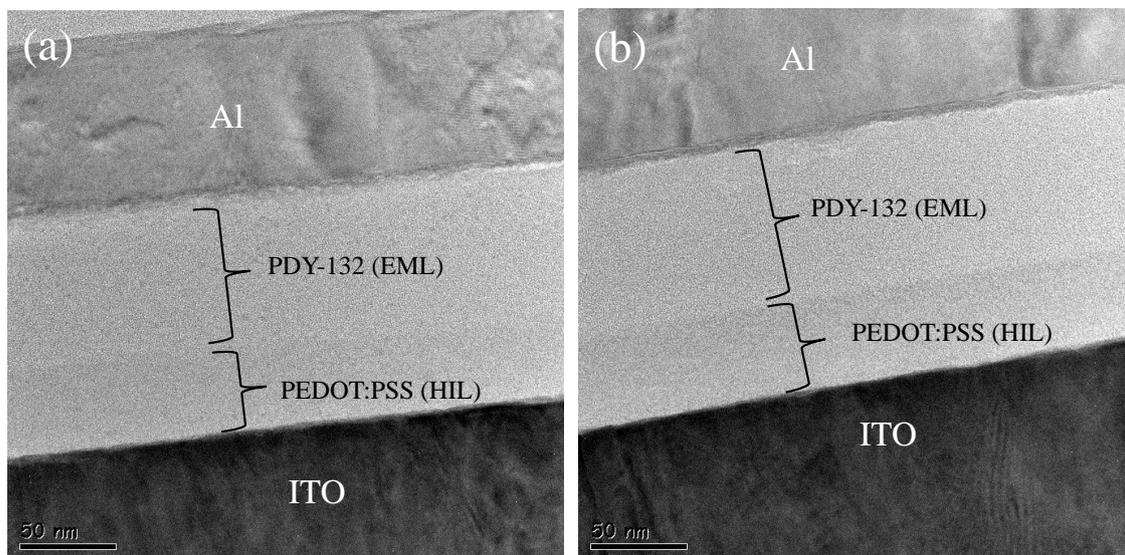
**Figure S4.** Lifetime of devices A (black circle), B (red triangle), C (green rectangle) and D (blue diamond) at  $1000 \text{ cd/m}^2$  with projected straight lines

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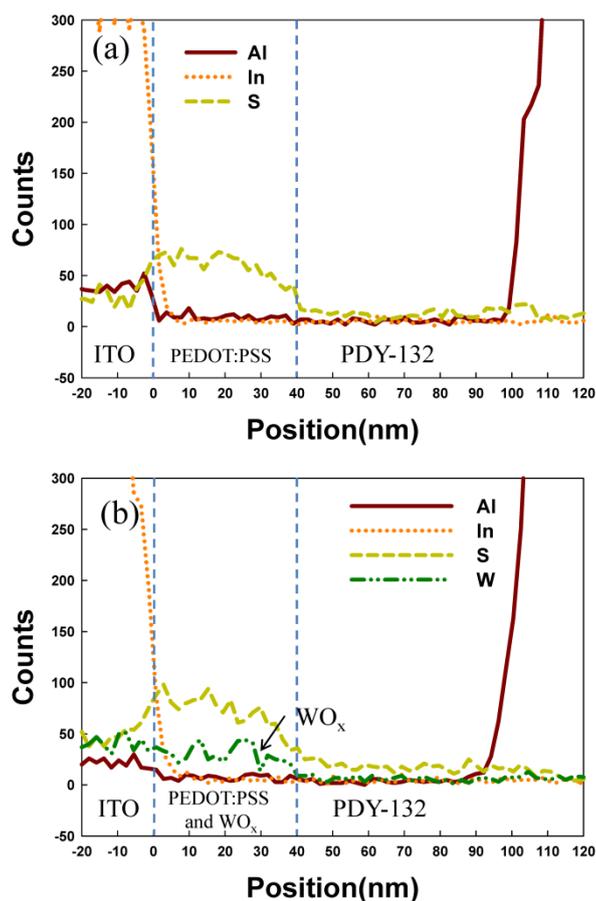
**Figure S5.** Luminance degradation data of devices A (black solid line), B (red dash line), C (green dot line) and D (green dash dot line) were measured at  $10000 \text{ cd/m}^2$ .

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**Figure S6.** The TEM images of the devices without operation; (a) device A and (b) device D.

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**Figure S7.** The atomic concentration profile from cross-sectional EDX spectra of the devices without operation; (a) device A and (b) device D ; Al (dark red solid line), In (orange dot line), S (dark yellow dash line) and W (green dash double dot line)

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