

## Supporting Information

### **Room-temperature spin organic light-emitting diodes based on two-dimensional Dion-Jacobson perovskites**

Chin-An Hsu, Lan-Sheng Yang, Pei-Hsuan Lo, Chun-Yao Huang, I-Chun Cheng\*, Yu-Chiang Chao\*

C.-A. Hsu, L.-S. Yang, P.-H. Lo, C.-Y. Huang, Prof. Y.-C. Chao  
Department of Physics  
National Taiwan Normal University  
Taipei 11677, Taiwan, R.O.C.  
E-mail: ycchao@ntnu.edu.tw

Prof. I-C. Cheng  
Graduate Institute of Photonics and Optoelectronics  
Department of Electrical Engineering  
National Taiwan University  
Taipei City 10617, Taiwan  
E-mail: iccheng@ntu.edu.tw

Keywords: Dion-Jacobson perovskites, circular dichroism, circularly polarized photoluminescence, magnetic field effect, dissymmetry factor

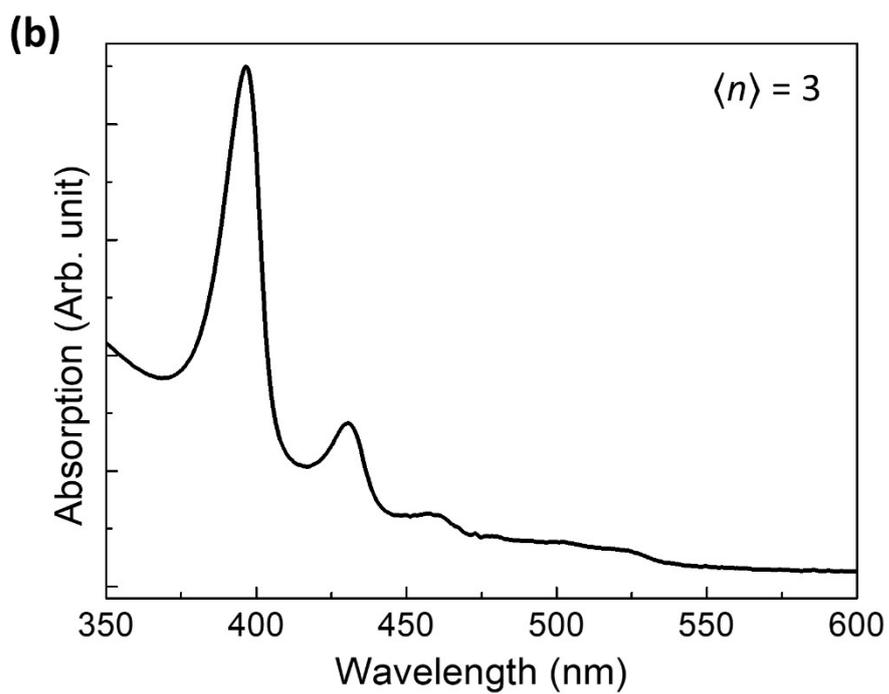
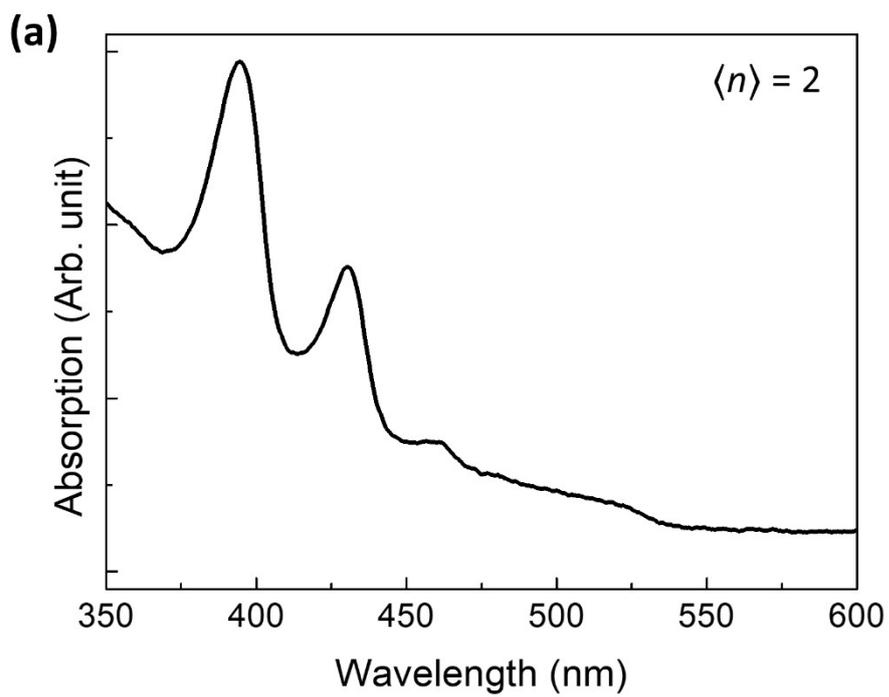


Figure S1 Absorption spectra of DJ perovskite films with (a)  $\langle n \rangle = 2$  and (b)  $\langle n \rangle = 3$ .





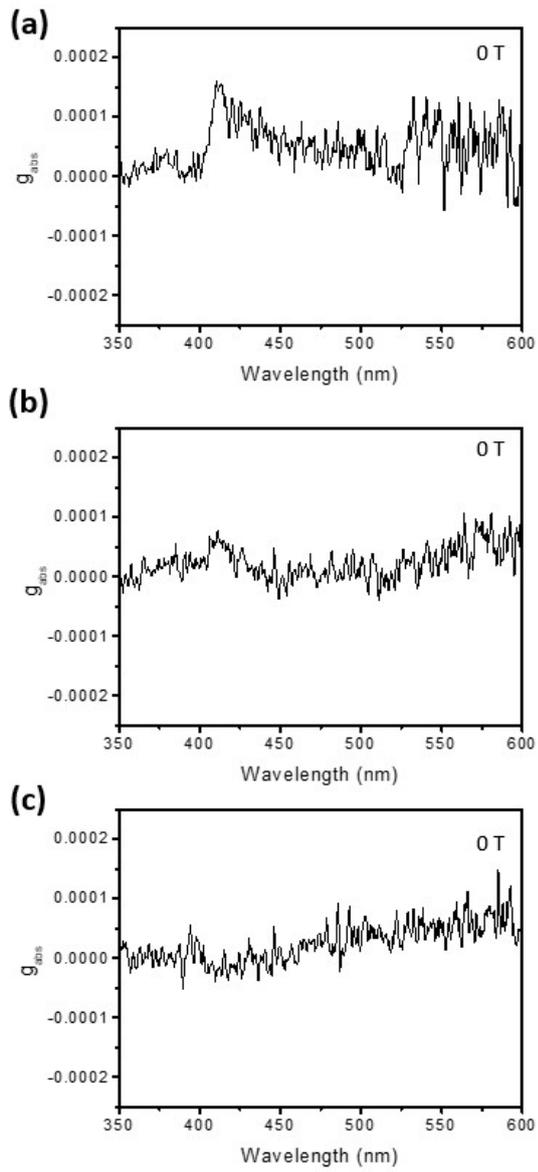


Figure S2  $g_{\text{abs}}$  spectra of films with (a)  $\langle n \rangle = 1$ , (b)  $\langle n \rangle = 2$ , and (c)  $\langle n \rangle = 3$ .

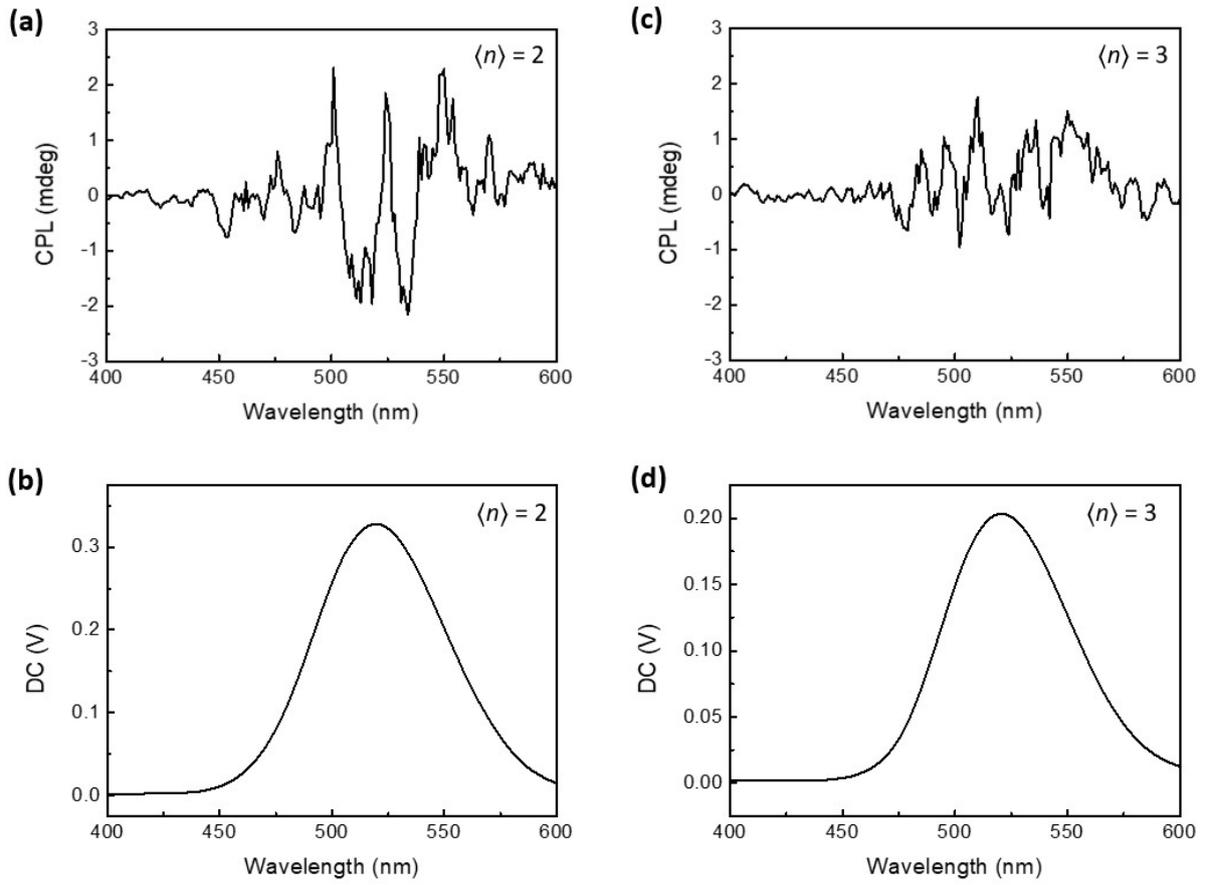


Figure S3 (a),(c) CPL and (b),(d) DC spectra of films with (a),(b)  $\langle n \rangle = 2$  and (c),(d)  $\langle n \rangle = 3$ .

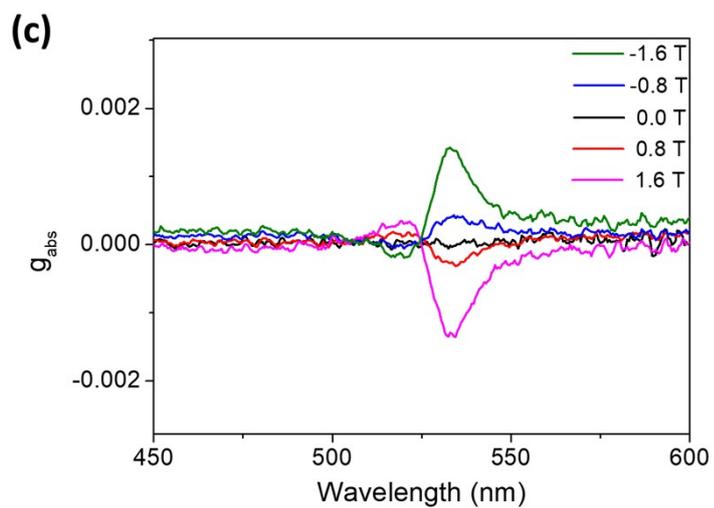
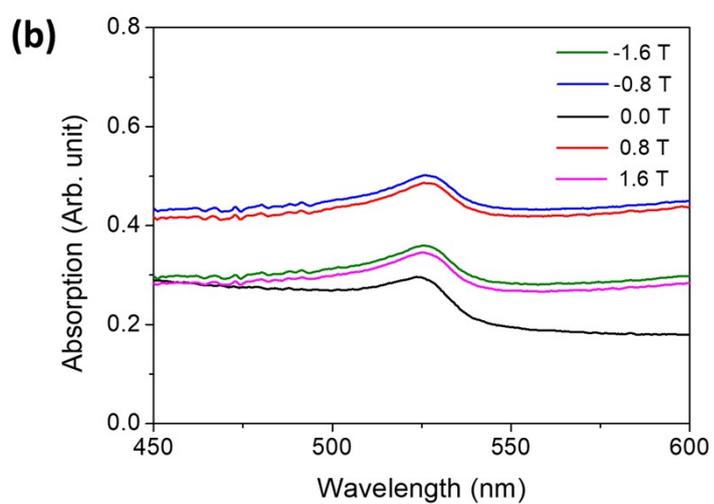
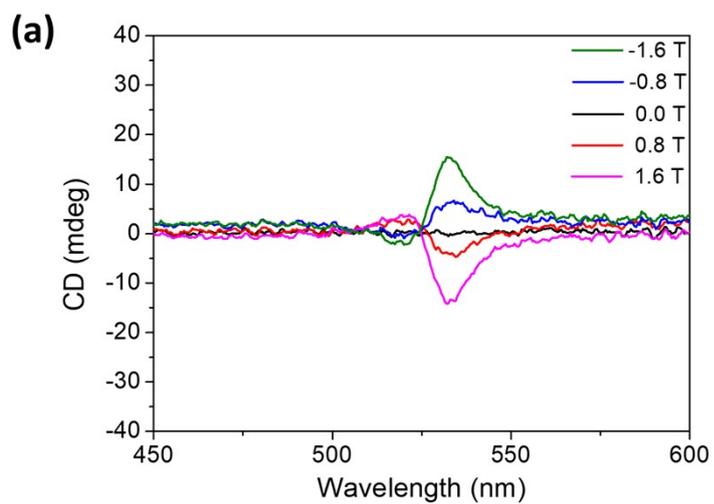


Figure S4 (a) CD, (b) absorption spectra, and (c)  $g_{\text{abs}}$  values of MAPbBr<sub>3</sub>.

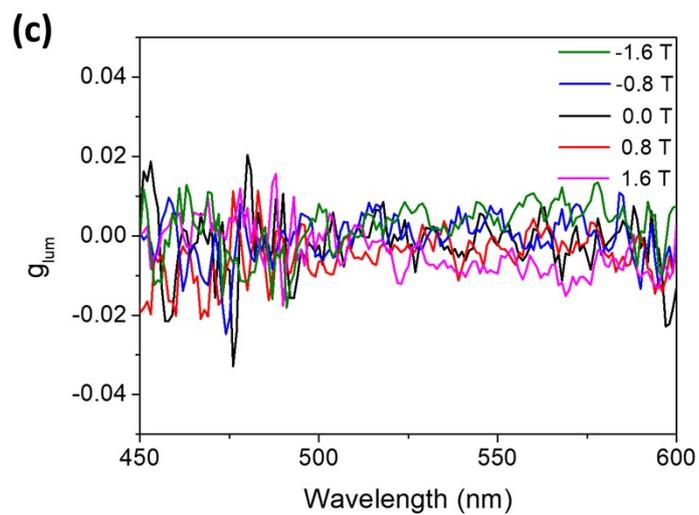
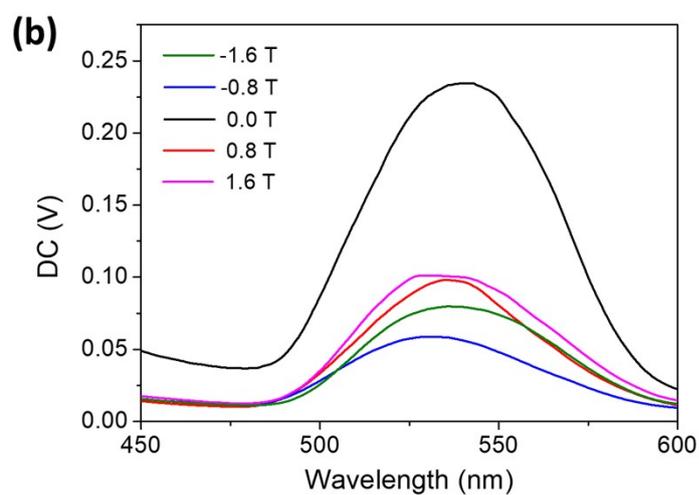
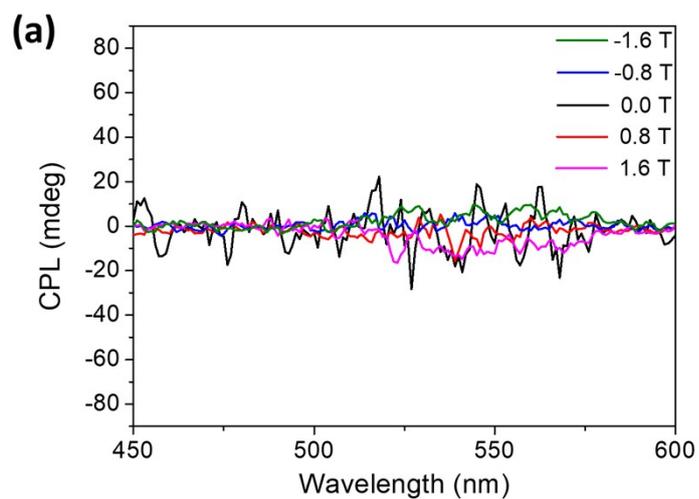


Figure S5 (a) CPL spectra, (b) DC, and (c)  $g_{lum}$  values of MAPbBr<sub>3</sub>.

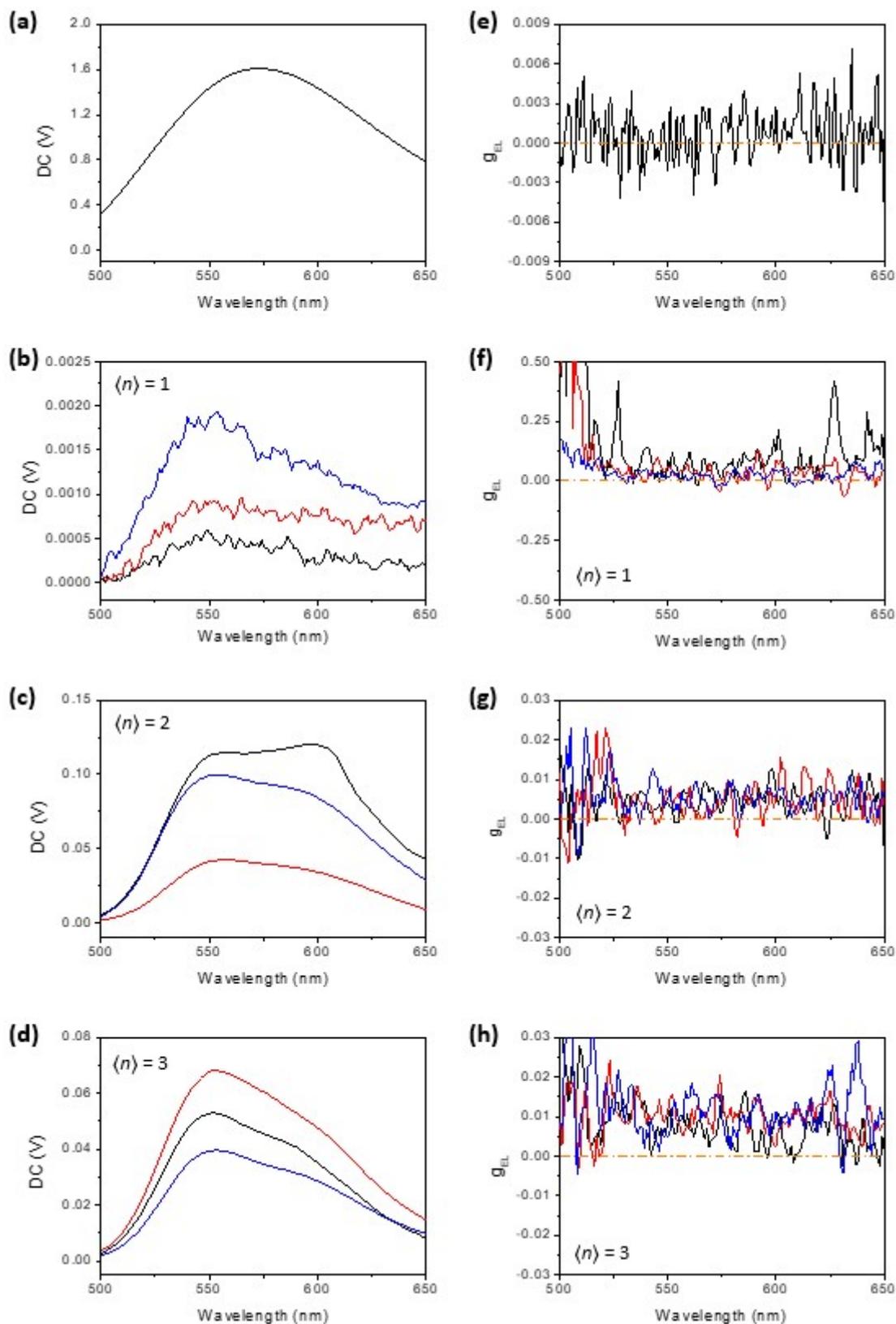


Figure S6 (a),(b),(c),(d) DC and (e),(f),(g),(h)  $g_{EL}$  of three spin-OLED (a),(e) without perovskite layer, (b),(f) with perovskite film with  $\langle n \rangle = 1$ , (c),(g) with perovskite film with  $\langle n \rangle = 2$ , and (d),(h) with perovskite film with  $\langle n \rangle = 3$ .

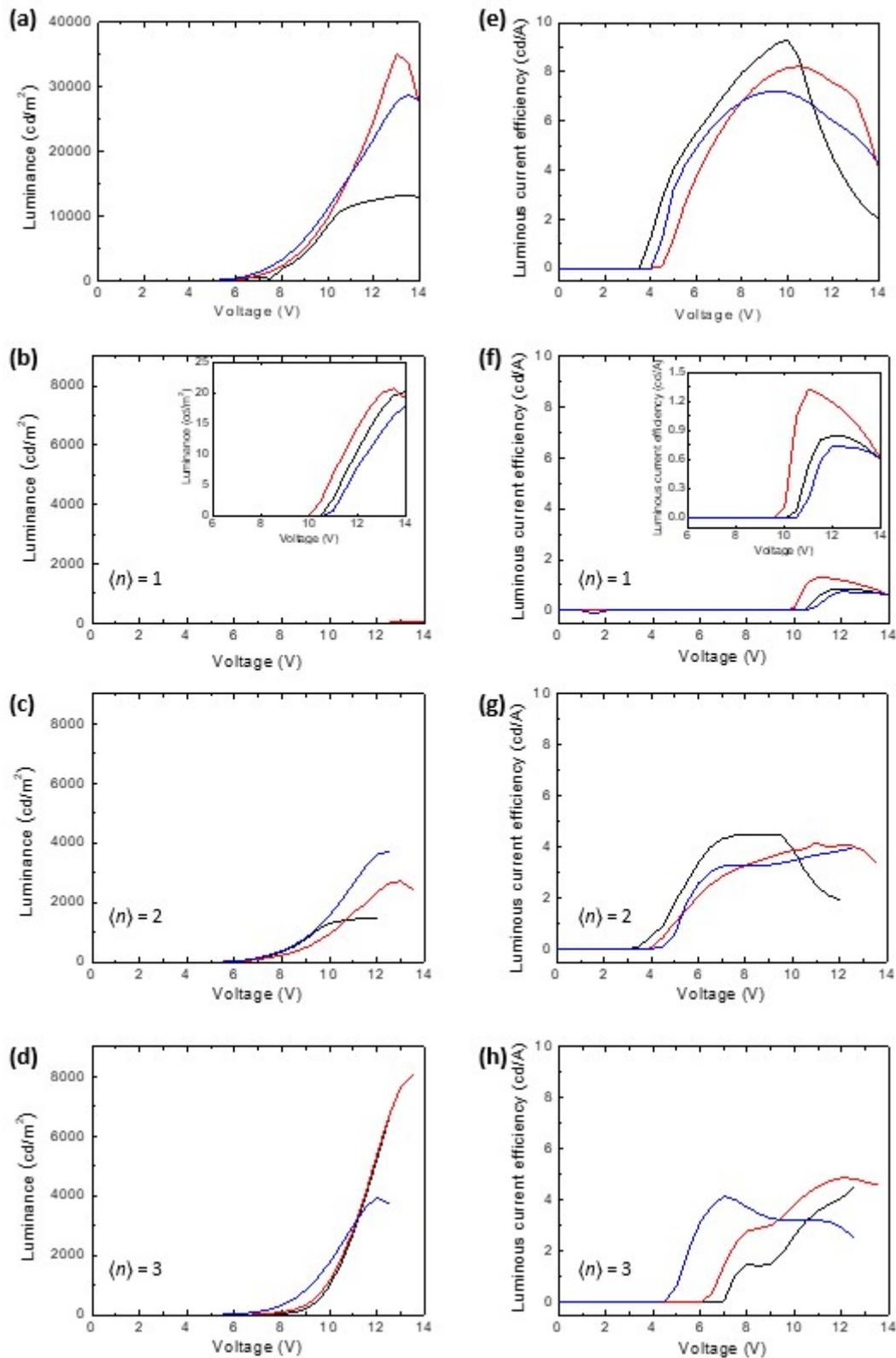


Figure S7 (a),(b),(c),(d) Luminescence and (e),(f),(g),(h) current efficiency of three spin-OLED (a),(e) without perovskite layer, (b),(f) with perovskite film with  $\langle n \rangle = 1$ , (c),(g) with perovskite film with  $\langle n \rangle = 2$ , and (d),(h) with perovskite film with  $\langle n \rangle = 3$ .

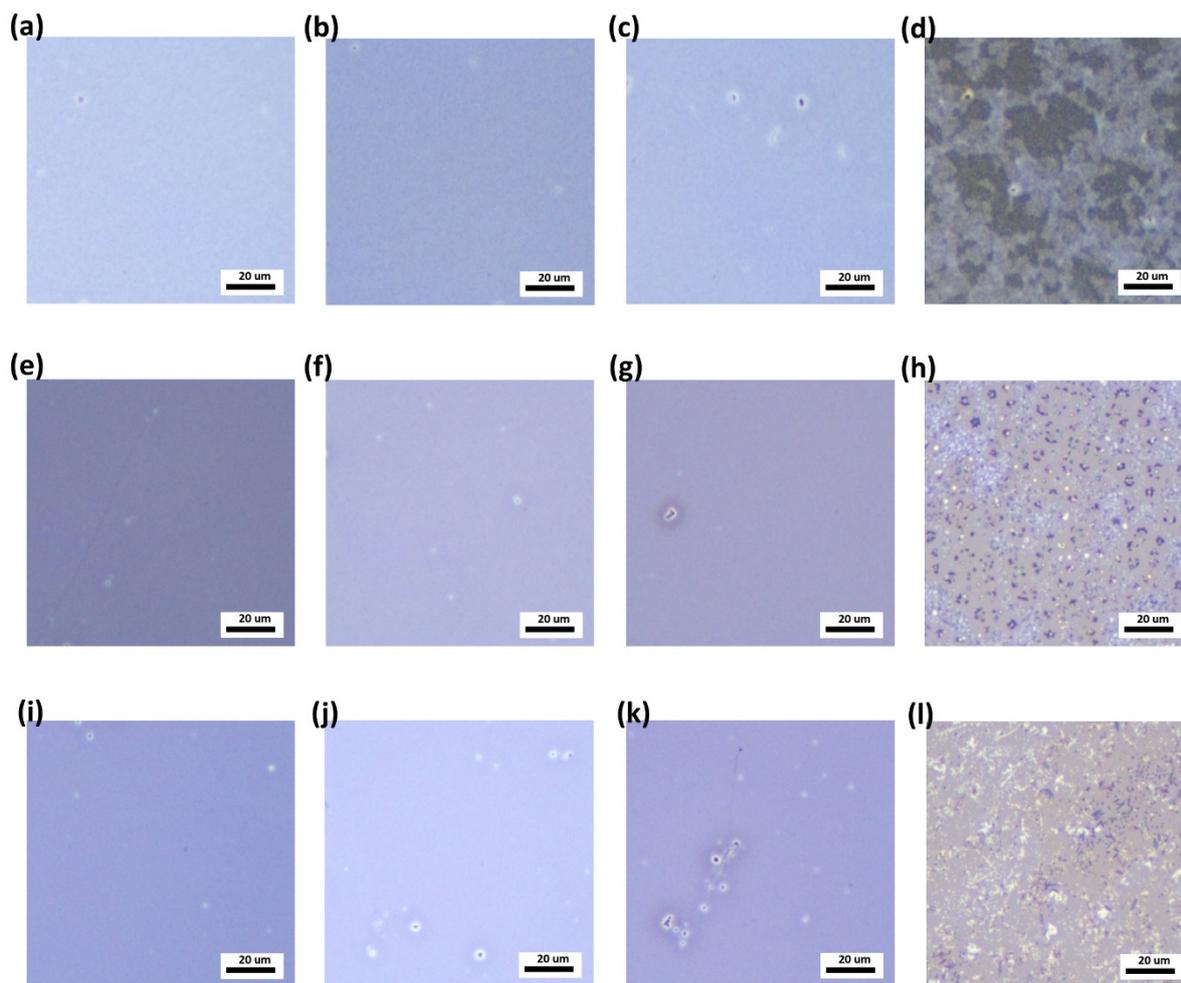


Figure S8 Optical microscopy images of DJ perovskite films with (a)–(d)  $\langle n \rangle = 1$ , (e)–(h)  $\langle n \rangle = 2$ , and (i)–(l)  $\langle n \rangle = 3$  with various air exposure durations of 0 ((a), (e), and (i)), 30 ((b), (f), and (j)), and 60 min ((c), (g), and (k)). (d), (h), and (l) The films were blown by mouth.

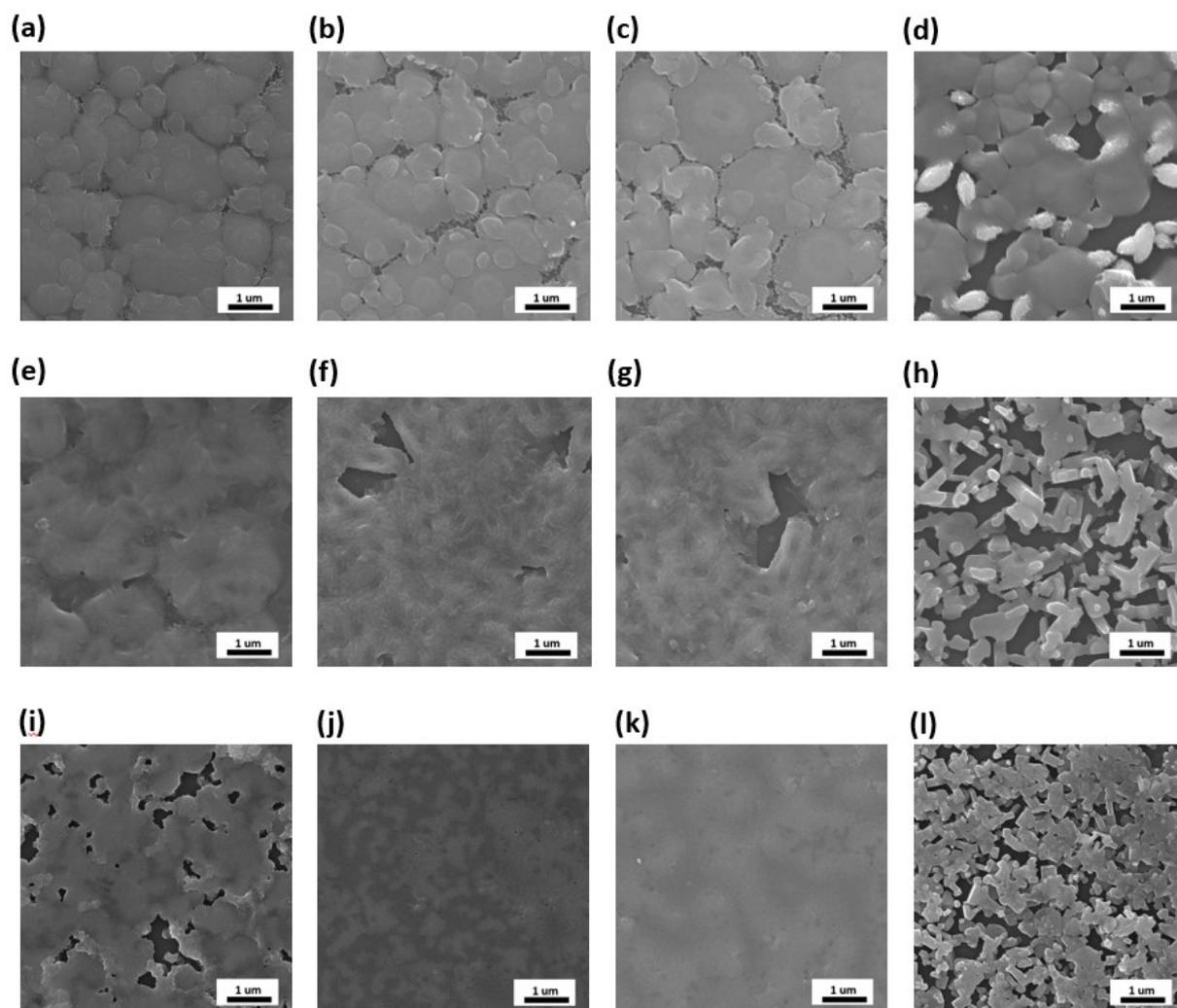


Figure S9 Scanning electron microscope images of DJ perovskite films with (a)–(d)  $\langle n \rangle = 1$ , (e)–(h)  $\langle n \rangle = 2$ , and (i)–(l)  $\langle n \rangle = 3$  with various air exposure durations of 0 ((a), (e), and (i)), 30 ((b), (f), and (j)), and 60 min ((c), (g), and (k)). (d), (h), and (l) The films were blown by mouth.

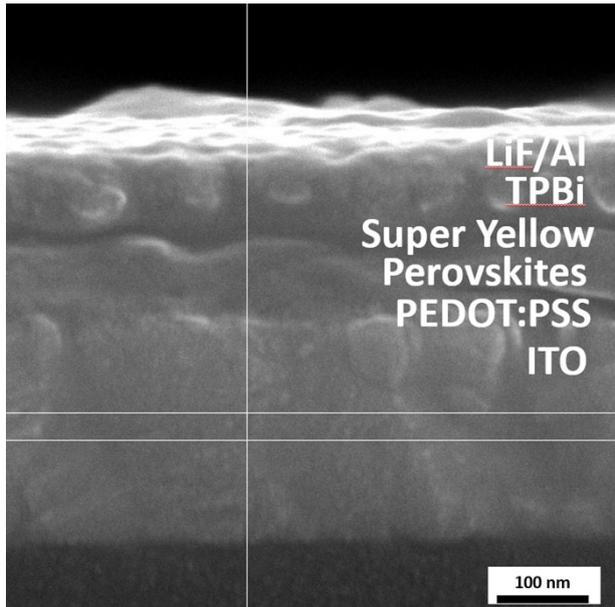


Figure S10 Cross-sectional SEM image of a spin light-emitting diode.

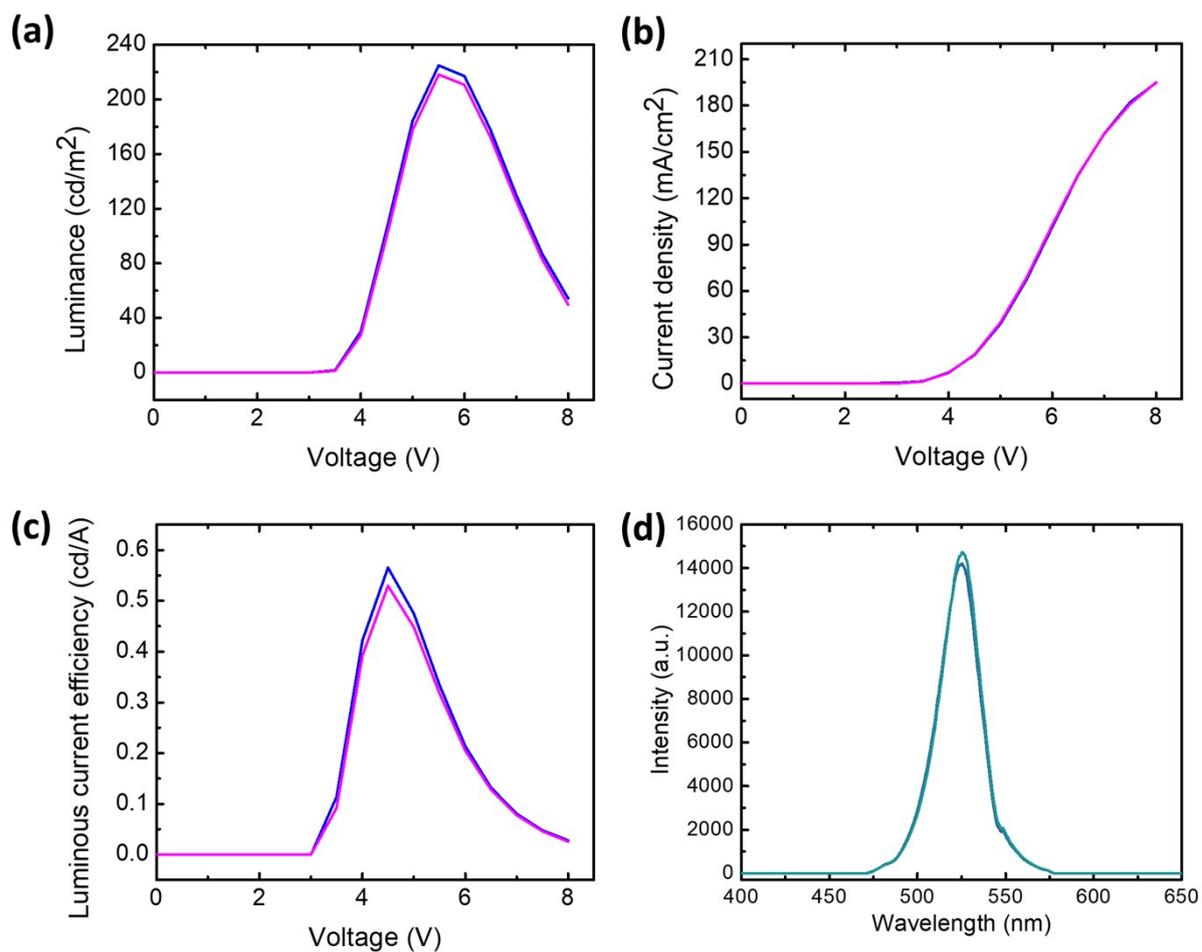


Figure S11 (a) Luminance–voltage curves, (b) current density–voltage curves, (c) current efficiency–voltage curves, and (d) electroluminescence spectra of two PeLEDs.