

Article

# Highly Transparent Red Organic Light-Emitting Diodes with AZO/Ag/AZO Multilayer Electrode

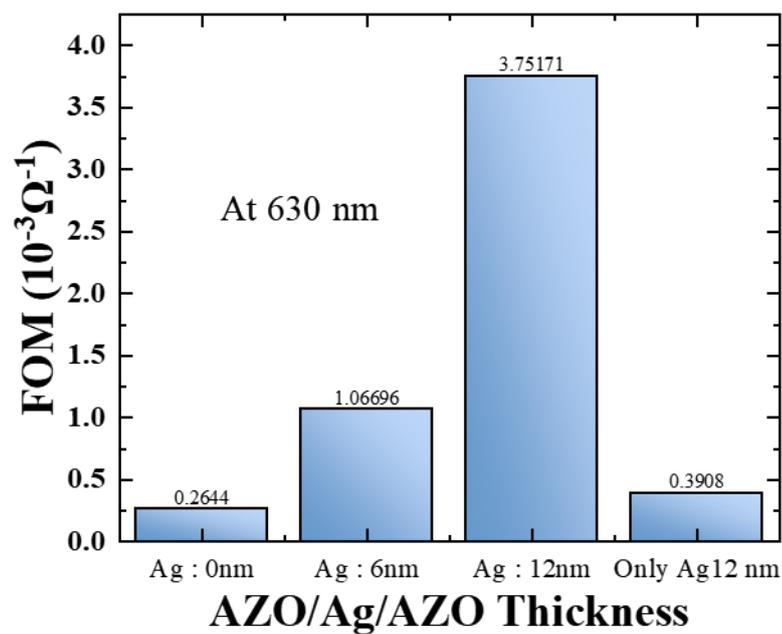
Dongwoon Lee <sup>1, †</sup>, Min Seok Song <sup>1, †</sup>, Yong Hyeok Seo <sup>1</sup>, Won Woo Lee <sup>1</sup>, Young Woo Kim <sup>1</sup>, Minseong Park <sup>2</sup>, Ye Ji Shin <sup>2</sup>, Sang Jik Kwon <sup>1</sup>, Yongmin Jeon <sup>2,\*</sup>, and Eou-Sik Cho <sup>1,\*</sup>

<sup>1</sup> Department of Electronics Engineering, Gachon University, Seongnam 13120, Republic of Korea.

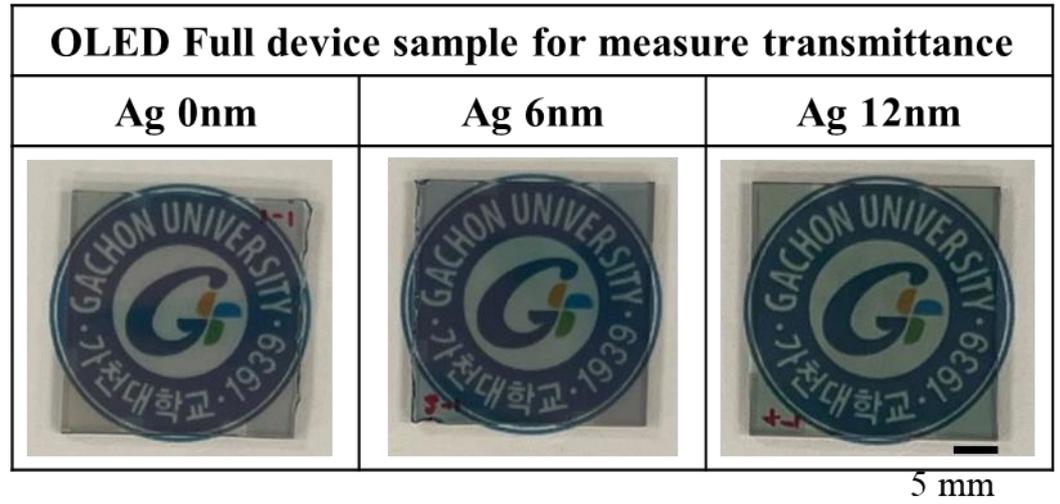
<sup>2</sup> Department of Biomedical Engineering, Gachon University, Seongnam 13120, Republic of Korea.

\* Correspondence: yongmin@gachon.ac.kr (Yongmin Jeon), es.cho@gachon.ac.kr (Eou-Sik Cho)

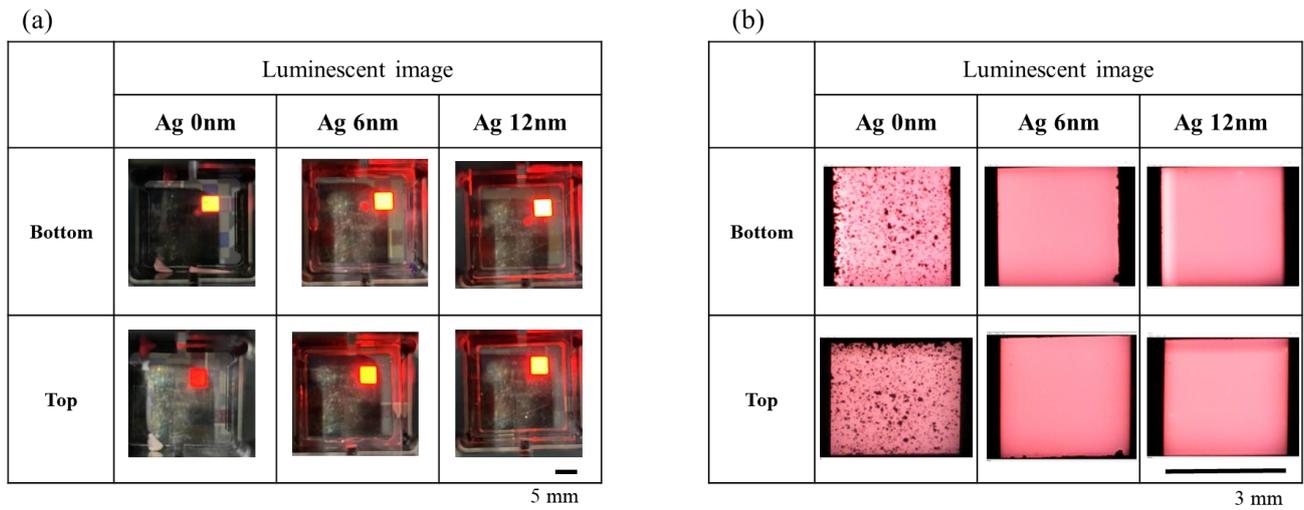
† These authors contributed equally to this work.



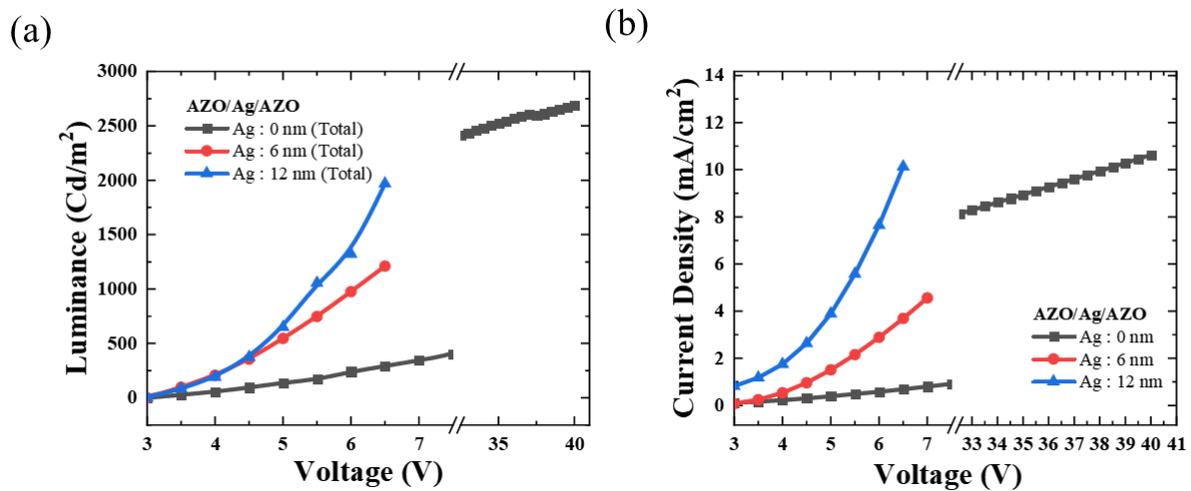
**Figure S1.** FOM value of the AZO/Ag/AZO at a wavelength of 630 nm according to the Ag thickness in Figure 1d.



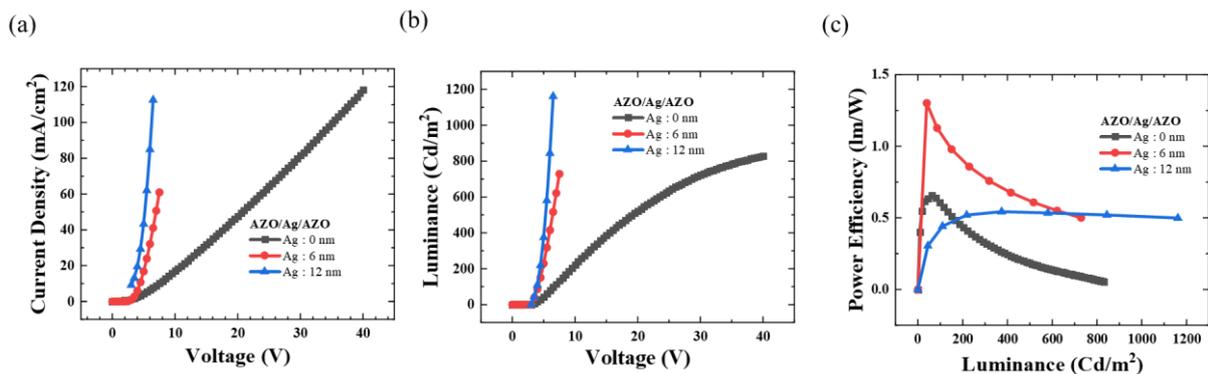
**Figure S2.** Optical imagery of the transparent red OLED for different Ag thickness in the AZO/Ag/AZO anode.



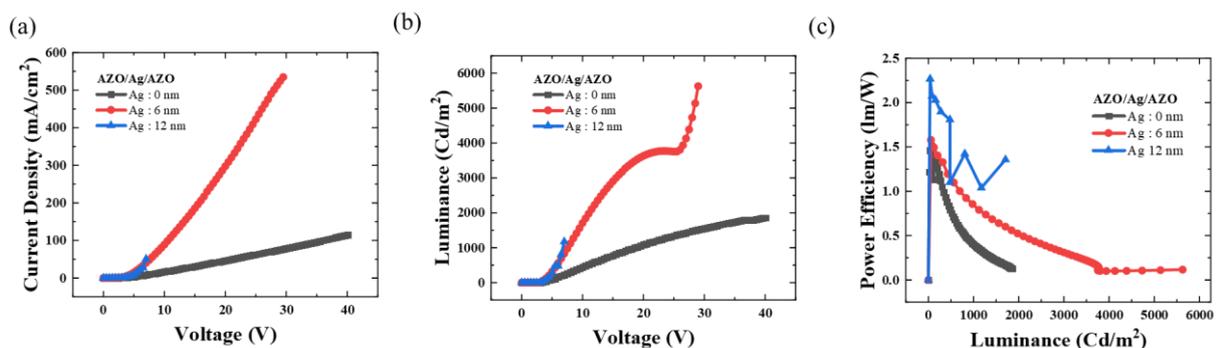
**Figure S3.** Luminescent imagery of the fabricated red OLED in both the top and bottom directions: (a) normal size, and (b) magnified size.



**Figure S4.** Analysis of the total emission characteristics of the fabricated transparent red OLED with different Ag thickness in the AZO/Ag/AZO anode: (a) The luminance–voltage characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode; (b) the current density – voltage characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode.



**Figure S5.** Analysis of the total emission characteristics of the fabricated transparent red OLED with different Ag thickness in the AZO/Ag/AZO anode: (a) the current density – voltage characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode; (b) The luminance–voltage characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode; and (c) the power efficiency – luminance characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode.



**Figure S6.** Analysis of the bottom emission characteristics of the fabricated transparent red OLED with different Ag thickness in the AZO/Ag/AZO anode: (a) the current density – voltage characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode; (b) the luminance–voltage characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode; and (c) the power efficiency – luminance characteristics of the fabricated red OLED for different Ag thickness in the AZO/Ag/AZO anode.