## **Electronic Supplementary Information**

## Enhancing UV-emissions through optical and electronic dualfunction tunings of Ag nanoparticles hybridized with n-ZnO nanorods/p-GaN heterojunction light-emitting diodes

Yung-Chi Yao, <sup>a</sup> Zu-Po Yang, <sup>\*b</sup> Jung-Min Hwang, <sup>ac</sup> Yi-Lun Chuang, <sup>a</sup> Jing-Yu Haung, <sup>a</sup> Chun-Yang Chou, <sup>a</sup> Jinn-Kong Sheu, <sup>d</sup> Meng-Tsan Tsai, <sup>e</sup> and Ya-Ju Lee <sup>\*a</sup>

<sup>a</sup> Institute of Electro-Optical Science and Technology, National Taiwan Normal University, 88, Sec.4, Ting-Chou Road, Taipei 116, Taiwan E-mail: yajulee@ntnu.edu.tw

<sup>b</sup> Institute of Photonic System, National Chiao-Tung University, 301, Gaofa 3rd Road, Tainan 711, Taiwan;
E-mail: zupoyang@nctu.edu.tw

<sup>c</sup> Solid-State Lighting Systems Department, Green Energy and Environment Research Laboratories, Industrial Technology Research Institute (ITRI), Hsinchu 310, Taiwan

<sup>d</sup> Department of Photonics, National Cheng Kung University, 1, University Rd., Tainan, 701, Taiwan

<sup>e</sup> Department of Electrical Engineering, Chang Gung University, 259, Wen-Hwa 1st Rd., Kwei-Shan Dist., Taoyuan, 33302, Taiwan



**Figure S1.** Absorption spectra of Ag (5nm) NPs fabricated by the RTA treatment in  $N_2$  (black line) and  $O_2$  (red line) ambient atmospheres.



**Figure S2.** Variations of the average diameter and density of (a) Ag NPs and (b) synthesized ZnO NRs.



**Figure S3.** Top-view SEM images of ZnO NRs fabricated by a sequence of synthesized conditions in a variance of the diameter of embedded Ag NPs (5/10/15nm) and the thickness of ZnO seed layer (10/30/50nm).



**Figure S4.** (a) XRD patterns of the ZnO NRs introducing with (blue line) and without (black line) Ag NPs (5 nm), and that of bare Ag NPs (5 nm) distributed on the sapphire substrate is also plotted (red line). Diffraction peaks indicated to (110) and (006) planes of the sapphire substrate are also marked (as triangle) in the figure. (b) Texture coefficient against diffracted crystalline planes [*(hkl)*] for the ZnO NRs introducing with and without Ag NPs (5 nm).