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EML doping 위치에 따른 적색 인광 OLED 특성 변화 연구

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본 연구에서는 Host-Dopant system 기반 적색 인광 OLED의 Emitting layer(EML)에서 doping 위치에 따른 특성 변화를 분석하였다. EML은 host 물질로 60 nm 두께의 CBP를 사용하고, 적색 발광을 위해 10 %의 $Ir(btp)_2$를 CBP의 Front, Middle, Back side에 각각 20 nm씩 doping하였다. 본 구조의 적색 인광 OLED는 current density, luminance, efficiency, EL spectrum 등을 통해 전기적, 광학적 특성 변화를 확인하였다. Front, Back side에 doping으로 인한 CBP의 Energy level이 3.6 eV에서 1.9 eV로 감소하여 각각 HTL/EML, EML/HBL의 경계에 carrier direct injection이 활성화 되었고, 이로 인한 charge balance의 저하를 확인하였다. EL spectrum결과 각 소자는 CBP의 618 nm 파장 외에도, 추가적으로 TPBi의 398 nm, NPB의 456 nm의 파장을 보였다. 이를 통해 doping 위치에 따라 exciton이 형성되는 recombination zone이 이동하고 있음을 확인하였고, Front side는 6 V의 인가전압에서는 발광 파장이 398 nm에서 높은 값을 보이나 8 V, 10 V, 12 V에서 618 nm에서 높은 값을 보이는 것으로 인가전압에 의해 recombination zone 이 HTL쪽으로 이동되는 것 또한 확인하였다.

Keywords: OLED, doping, carrier direct injection, recombination zone

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Enhancement of Nitric Oxide with nonthermal plasma jet and its effect on Escherichia coli inactivation and various type of cancer cell

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A new approach for antimicrobial is based on the overproduction of reactive nitrogen species (RNS), especially; nitric oxide (NO) and peroxinitrite ($ONOO^{\neg}$-) are important factors to deactivate the bacteria. Recently, non-thermal atmospheric pressure plasma jet (APPJ) has been frequently used in the field of microbial sterilization through the generation of different kinds of RNS/ROS species. However, in previous study we showed APPJ has combine effects ROS/RNS on bacterial sterilization. It is not still clear whether this bacterial killing effect has been done through ROS or RNS. We need to further investigate separate effect of ROS and RNS on bacterial sterilization. Hence, in this work, we have enhanced NO production, especially; by applying a 1% of HNO3 vapour to the N2 based APPJ. In comparison with nitrogen plasma with inclusion of water vapour plasma, it has been shown that nitrogen plasma with inclusion of 1% of HNO3 vapour has higher efficiency in killing the E. coli and different type of cancer cell through the high production of NO. We also investigate the enhancement of NO species both in atmosphere by emission spectrum and inside the solution by ultraviolet absorption spectroscopy. Moreover, qPCR analysis of oxidative stress mRNA shows higher gene expression. It is noted that 1% of HNO3 vapour plasma generates high amount of NO for killing bacteria and cancer cell killing.

Keywords: Reactive nitrogen species, Reactive oxygen species, Oxidative stress, plasma and cancer cell.