**Introduction and Experiments**

Multilayer organic light-emitting devices (OLEDs) have attracted much attention because of their potential use in lightweight, fast-response full-color displays or lighting application ever since Tang and Van Slyke reported the first efficient OLED.[1] Lots of work has been put into improving the performance of OLEDs and understanding their underlying mechanisms. Performances of OLEDs depend on the efficiency of carrier injection and the efficiency recombination as well as the balance of the holes and electrons have been recognized.[2] However, hole’s mobility is generally a few order of magnitude higher than electron’s mobility in most organic materials.[3] Quantum-well structure is widely acknowledged to be helpful in reducing hole’s mobility and obtaining higher emission efficiency.[4] According to previous researches, some kinds of organic materials were adopted to form organic/organic multiple quantum-well (MQW) structure and obtained good results.[5, 6] However, there is few study on adopting inorganic material to form inorganic/organic MQW structure for OLEDs.

Here we reported white OLEDs with MQW structure formed by sodium fluoride which hole blocking characteristic has been demonstrated.[2] The structure of OLED studied is: ITO/CuPc/(NaF/NPB)/NPB/MADN:Rubrene/TPBI/LiF/Al. And n is number varied from 0 to 2. ITO/CuPc/(NPB/C545T or NaF)/NPB/MoOx/Al is hole only device structure. Admittance spectroscopy of devices with structure ITO/NPB · NaF · C545T/Al is performed to discuss the electrical behavior of MQW structure by using Agilent 4294A network analyzer with an oscillation level of 0.1V.

**Results and Discussions**

**Schematic energy level diagram and device structure**

=>Similar work function

**J-V-L and yield characteristics of WOLEDs with different multiple quantum well structures**

=>Very different results.

**J-V characteristics of hole-only devices with different multiple quantum well structures**

In summary, the effect of MQW structure consisted of inorganic material was demonstrated. Brightness, current efficiency is significantly enhanced with a NaF/NPB MQW structure is inserted. The admittance spectroscopy was measured to explain the different mechanism and effect of reducing hole from both organic and inorganic/organic MQW structures. With proper inorganic materials consisting of optimal MQW structure, it could lower the mobility of hole-transporting layer and reducing the amount of holes to optimum value and increases the devices performance.

**Conclusion**

In summary, the effect of MQW structure consisted of inorganic material was demonstrated. Brightness, current efficiency is significantly enhanced with a NaF/NPB MQW structure is inserted. The admittance spectroscopy was measured to explain the different mechanism and effect of reducing hole from both organic and inorganic/organic MQW structures. With proper inorganic materials consisting of optimal MQW structure, it could lower the mobility of hole-transporting layer and reducing the amount of holes to optimum value and increases the devices performance.

**Spectra of the admittance spectroscopy, measured on a device with an ITO/Various materials (70 nm)/Al structure. Inset is of the photo how the measurement of admittance spectroscopy was performed.**

**Reference**