

Water Vapor Oxidization of NiO for a Hole Transport Layer in All Inorganic QD-LED

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Abstract : Quantum dots light-emitting diodes (QD-LEDs) have been considered as the next generation display and lighting devices due to their excellent color purity, photo-stability solution process possibility and good device stability. Currently typical quantum dot light emitting diodes contain organic layers such as PEDOT:PSS and PVK for charge transport layers. To make quantum dot light emitting diodes (QD-LED) more stable, it is required to replace those acidic and relatively unstable organic charge transport layers with inorganic materials. Therefore all inorganic and solution processed quantum dot light emitting diodes can potentially be a solution to stable and cost-effective display devices. We studied solution processed NiO films to replace organic charge transport layers that are required for stable all-inorganic based light emitting diodes. The transition metal oxides can be made by various vacuum and solution processes, but the solution processes are considered more cost-effective than vacuum processes. In this work we investigated solution processed NiOx for a hole transport layer (HTL). NiOx, has valence band energy levels of 5.3eV and they are easy to make sol-gel solutions. Water vapor oxidation process was developed and applied to solution processed all-inorganic QD-LED. Turn-on voltage, luminance and current efficiency of QD in this work were 5V, 1800Cd/m² and 0.5Cd/A, respectively.

Keywords : QD-LED, metal oxide solution, NiO, all-inorganic QD-LED device

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