ELECTROLUMINESCENCE PROPERTIES OF ZnO/Alq3/PEGDE/Al STRUCTURE

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The efficiency of organic light emitting diodes (OLED) is highly dependent on the injection behavior of the contacts. In the present work, the OLED based on tris (8-hydroxyquinoline) aluminum (Alq_3) was studied. Highly transparent and conductive zinc oxide film as an anode and poly(ethylene glycol) dimethyl ether (PEGDE) as an ultra-thin film buffer layer with an aluminum (Al) cathode were used for device fabrication.

ZnO thin film was deposited on glass substrate using the Atomic Layer Deposition (ALD) technique. We used diethylzinc (DEZn) and deionized water as zinc and oxygen precursors, respectively. ZnO films were grown at 200ºC and the film thickness was about 200nm. So-obtained films show carrier concentration of $\sim 10^{20} cm^{-3}$ and the resistivity of $2 \cdot 10^{-3}$ Ohm·cm. An important point of our approach was that ZnO films were not intentionally doped (with Al or other group III elements) but the required sample conductivity was achieved by playing with the sample stoichiometry and growth conditions.

Alq_3 (Sigma, Aldrich ltd.) films were vacuum-deposited on ZnO/glass substrates at room temperature and a residual pressure not exceeding 10^{-5} Torr. The film deposition rate was 0.8 nm/s. The thickness of the formed Alq_3 film was approximately 100–120 nm. With an aim to prevent Al reaction with organic materials during vacuum thermal evaporation, a thin film (1-3 nm) of PEGDE was vacuum-deposited on Alq_3 surface. Aluminum thin film with a thickness not exceeding 200 nm was deposited by vacuum evaporation on the structure's surface.

Current–voltage, electroluminescence characteristics and frequency dependent impedance of the fabricated OLED were studied.