MASTER'S THESIS

Optical and electrical properties of aluminum-doped ZnO

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Optical and Electrical Properties of Aluminum-doped ZnO

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DECLARATION

I hereby declare that this thesis represents my own work which has been done after registration for the degree of M.Phil at Hong Kong Baptist University, and has not been previously included in a thesis, dissertation submitted to this or other institute for a degree, diploma or other qualification.

Signature:_____

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ABSTRACT

In the past few years, “green” technologies and touch screen technologies for portable devices has came to hot topic in consumer market. The demand for transparent conducting oxides (TCO) is increasing continuously. Therefore, the potential replacement of indium tin oxide (ITO), which is the most widely used TCO in industry, by aluminum zinc oxide (AZO) draws much attention in order to solve the problem of shortage of ITO one day due to the consisting of rare-earth element.

In this work, electrical and optical properties of AZO had been characterized according to different sputtering parameters such as oxygen contents, working pressures and gas flow ratios. Physics of electrical conduction and optical transparency of AZO films were revealed and analyzed in order to set up a more complete relationship between mechanism and performance. Meanwhile, a comparison of sensitivity between AZO and zinc oxide (ZnO) to sputtering environment had been made and behaviors of AZO at low temperature had been presented.

Optimum sputtering conditions for AZO had been established as a function of sputtering time and the film resistivity reached down to $7 \times 10^{-4}\ \Omega\cdot$cm while film transmittance was above 85% when t = 140 mins having film thickness about 610 nm. Degradation of AZO had been investigated. Application of AZO in OLED fabrication had been carried out after film refinement and device performance had been given. Finally, simulation of OLED structure was done for better device performance.

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