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利用寬頻兆赫波光譜儀研究實用透明導電薄膜的光電特性

The studies of functional transparent conductive oxide thin films by broadband terahertz spectroscopy

中文摘要

本論文利用光導天線與雷射光激發電漿之兆赫波時域光譜儀研究透明導電氧化物薄膜(氧化銦錫、摻鋁氧化鋅與摻鋁鎵氧化鋅)在不同薄膜厚度下於兆赫波段的光學常數與導電率。本論文的實驗結果指出所研究之摻鋁氧化鋅薄膜與摻鋁鎵氧化鋅薄膜的電性參數略差於氧化銦錫薄膜但兆赫波段的穿透率較好。這三種薄膜的電性參數的差距可由晶粒大小、結晶相與載子濃度討論之。

英文摘要

The transparent conductive oxides (TCOs, indium-tin oxide (ITO), aluminum-doped zinc oxide (AZO), aluminum and ytterbium-doped zinc oxide (AYZO)) thin films which exhibit outstanding properties such as high transparency in the visible region and good electrical conductivity are measured by terahertz time-domain spectroscopy (THz-TDS) based on photoconductive (PC) antenna and laser-induced air-plasma. By fitting complex conductivities of the TCOs with the Drude-Smith model, electrical properties such as DC mobility ( $\mu$ ), carrier concentration ( $N_e$ ), and DC conductivity ( $\sigma_{DC}$ ) are obtained. Together with the X-ray diffraction information, it can be concluded that motilities can be enhanced as increasing grain size, but reduced with overly high carrier concentration because of the smaller distance between impurity ions.

