Characteristics of Low-temperature Deposited ZnO:N Thin Films on Various Substrates

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ABSTRACT

In this study, ZnO:N thin films on Si, polyimide, and glass substrates were fabricated by the rf magnetron sputtering system. In the first phase, films were deposited under the working pressure hold on 40 mtorr with rf power 100 W. The working gas were mixed with Ar and N2 with different N2 partial pressure (0 %、0.5 %、25 %、37.5 %、50 %、100 %). The X-ray diffraction results show that the samples deposited on Si, polyimide are better at crystallinity at N2 partial pressure 37.5 % (15 mtorr), and the films deposited on glass substrates have the best crystallinity at N2 partial pressure at 10 mtorr (25 %). Raman spectroscopy analysis of the as-deposited films shows strong nitrogen related local vibration mode at 257, 575 cm-1, that has been attributed to the nitrogen were already incorporated into the ZnO films. To characterize the transport properties of deposited thin films, resistivity, carrier concentration, and carrier mobility were measured by the Hall effect measurement system. In the second phase, the films were deposited with different substrate temperature (200 ?aC and 300 ?aC), fixed the rf power 100 W and working pressure 40 mtorr with N2 partial pressure 37.5 % (15 mtorr). The Raman spectra show that the nitrogen are incorporating into ZnO crystals. Finally, from transport characterizations, we show that the low-resistivity p-type ZnO:N thin films have been successfully prepared.

Keywords : XRD、Raman Spectroscopy、Hall effect measurement、LVMs

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