Sol-Gel 공정을 이용한 ZnO 쇼트키 다이오드의 제작 및 특성평가

Fabrication and Characterization of ZnO Schottky Diode Using Sol-Gel Process

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Abstract : We fabricate Schottky diodes with the contact between a sol-gel derived ZnO layer and Au that guarantees the expected Schottky contact due to the high work function. The formed single metal Schottky barrier shows characteristics comparable to the barrier formed by alloys. Au is deposited by thermal evaporation on a ZnO thin film that is optimally formed under sol-gel process conditions of a 1-mol zinc acetate concentration and a 3000-rpm coating speed. Possible defects, which can provide deleterious current paths, are minimized by patterning the deposited Au. The I-V curve verifies the formation of a Schottky contact. Measurements showed that the Schottky barrier height and leakage current at -5 V were 0.6 eV and $1x10^{-12}$A, respectively.

Key Words : Schottky, Diode, ZnO, Sol-Gel, Thin Films

1. 서 론

ZnO, one of the most attractive semiconductor materials, has notable advantages, including good carrier mobility, a wide direct band gap energy (3.3 eV), and a large exciton binding energy (60 meV), making it ideal for short-wavelength optoelectronics, transparent electronics, and active channel layers of thin-film transistors. In order to realize devices that can accelerate applications, quality-guaranteed metal-semiconductor contacts are greatly meeded. Unlike Schottky contacts based on ZnO thin films, many metallization schemes for ohmic contacts, including Ti/Au, Pt/Ga and Al/Pt, have been reported, adopting either all alloy or double layers. In this work, a Schottky contact composed of Au and ZnO thin films deposited on sapphire (0001) substrates by the sol-gel process is demonstrated.

2. 결과 및 토의

The SEM images shows the annealed ZnO thin films has an average thickness of about 185 nm. As a result, a fast coating speed can reduce the average films thickness and improve the flatness of the ZnO films. The PL spectra measured at RT, depict the quality of the ZnO thin films deposited at 1000 rpm and 3000 rpm, respectively, followed by the annealing at 650°C for 1 h in an air environment. It is obvious that the defects in the film synthesized at 1000 rpm are more serious than those in the film processed at 3000 rpm. Our Schottky device formed with a single metal and a sol-gel ZnO film. In order to suppress any deleterious current paths between the Au layer and the ZnO thin film, we designed the contact to have minimum area in order to reduce the possibility of including the defects within the area. The contact area with the patterned Au layer has dimensions of 90 um x 3 mm. The *I-V* curve shows the Schottky behavior of the Au-ZnO contact, which corresponds to alow leakage current and a high quality of the contact due to the patterned Au deposition. *I-V* measurements showed that the Schottky barrier height and leakage current at -5 V were 0.6 eV and $1x10^{-12}$A, respectively.

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참고 문헌

[1] J. H. Lee, K. K. Kim, S. J. Park and W. K. Choi, Appl. Phys. Lett., 78, 3842, 2004.
[2] H. J. Chang, C. Z. Lu, Y. Wang, C. S. Song, S. I. Kim, Y. H. Kim and I. H. Choi, J. Korean Phys. Soc., 45, 4, 2004.

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