Influence of Technological Parameters on the Properties of NiO Thin Films Deposited on Si and Glass Substrates by the Layer-by-layer Growth Method at Magnetron Sputtering

A.I. Ievtushenko[1], V.A. Karpyna[1], P.M. Lytvyn[2], A.A. Korchovyi[2], S.P. Starik[3], O.I. Olifan[1], S.F. Korichev[1], S.V. Tkach[3], E.F. Kuzmenko[3], V.A. Baturin[4], O.Y. Karpenko[4] and G.V. Lashkarev[1]

[1]I. Frantsevich Institute for Problems of Material Science, NASU, Kyiv, Ukraine,
[2]V. Lashkarev Institute of Semiconductor Physic, NASU, Kyiv, Ukraine
[3]V.Bakul Institute for Superhard Materials, NASU, Kyiv, Ukraine
[4]Institute of Applied Physics, NASU, Sumy, Ukraine

NiO is a wide direct band gap p-type semiconductor material (E_g=3.5–4.0 eV at room temperature). NiO is an attractive material for development of p-type transparent conductive films, ultraviolet detectors, solar cells, spin-valve giant magnetoresistive sensor, electrochromic window devices, gas sensors, etc due to its low cost, electro-chemical stability and great durability as well as unique optical, electrical and magnetic properties [1]. The development of high quality p-NiO/n-ZnO p-n heterojunctions is important task for new type of solar cells (SC) – transparent SC (so-called UV active SC) [2] that have additional possibilities for application in window systems of houses, greenhouses comparison with traditional arrangement of SC on roofs of houses.

Reactive magnetron sputtering (MS) is considered to be most widely used growth method due to good films adhesion, high deposition rates, films uniformity of over large areas of the substrates and easy control over the composition of the deposited films [3]. It is clear that the improvement of NiO films properties can be reached by the optimization of their deposition parameters. Earlier we developed layer-by-layer growth method [3] for improvement crystalline structure of ZnO films deposited by reactive magnetron sputtering on different crystalline and amorphous substrates.

Therefore, our report devoted to investigation of the influence of such technological parameters of MS as substrate temperature, oxygen and argon pressure, magnetron power on structure, morphology and optical properties of NiO thin films deposited on Si (111) and glass substrates by using layer-by-layer growth method at MS. The properties of as-grown NiO films were studied by using X-ray diffraction, atomic force microscopy (AFM), energy dispersive X-ray spectroscopy (EDX), Fourier transform infrared spectrometry (FTIR) and optical transmission measurements. Obtained results will be discussed and presented.

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