Effect of temperature and oxygen partial pressure on the growth and development of Cu2O nanorods by radio frequency magnetron sputtering

Jae-Lok You*, Kwang-Min Jo, Se-Yoon Kim, Joon-Hyung Lee, Jeong-Joo Kim, Young-Woo Heo
School of Materials Science and Engineering, Kyung-Pook National University, Deagu 702-701 Republic of Korea
ywheo@knu.ac.kr

abstract : As an important p-type semiconductor metal oxide with a narrow band gap (1.2 - 2.6eV), copper oxide (Cu2O) has been studied because of its various applications as material for heterogeneous catalysts, gas sensors, optical switch, lithium-ion electrode materials, field emission devices, solar cells. The fundamental properties of oxide-semiconductor can be greatly affected by the surface morphology, size, geometry and spatial orientation.

1. Introduction

Various nanostructures of Copper oxide such as nanotubes, nanowires, nanofibers, and nanorods structures have already been synthesized by a variety of methods, including sol‐gel process, hydrothermal treatment, and electrochemical deposition. Until now, there has been no report about the growth of Cu_2O nanorods by reactive radio frequency magnetron sputtering.

2. Main subject

Until now, there has been no report about the growth of Cu_2O nanorods by reactive radio frequency magnetron sputtering. In this study, we examined the growth behavior and the formation of Cu_2O nonorods using reactive rf-magnetron sputtering. The Cu_2O nanorods we reprepared on glass substrates by reactive rf-magnetron sputtering with a Cu-metal target. The influences of growth temperature and oxygen partial pressure (O2/(Ar+O2)=3%, 5%, 7%) on the microstructure and crystal structure of deposited Cu_2O nanorods/films were investigated. The phase and the microstructure of the Cu_2O nanorods/films were analyzed by x-ray diffraction (XRD) and field-emission scanning electron microscopy (FE-SEM).

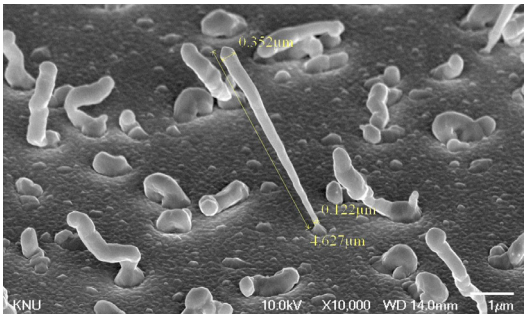

Fig 1. FE-SEM image of the Cu_2O nanorods

3. Results and Discussion

The growth of the nanorods was only found at conditions of oxygen partial pressure of 3% 5% and the nanorods shape varied depending on value of the oxygen partial pressure. Beside there were no rods in the condition of 7%. Therefore, we can expect to be a key factor in Cu-metal affects the growth of Cu_2O nanorods. Growth behavior showed the difference of the deposition time and growth temperature. At the growth temperature of 550^{o}C,the nanorods length was proportional to the sputter time. The nanorods diameter was increased rather than the growth of the length of the nanorods. Finally, the growth behavior of Cu_2O nanorods by rf-magnetron sputtering will be discussed.