Characteristics of Tungsten Disulfide Thin Films by RF Sputtering on Soda-lime Glass substrate and Subsequent Rapid Thermal Annealing

In Hwan Kim [1], Hanyeob Nam [2], Sang Jik Kwon [2], and Eou-Sik Cho [1]

[1]Gachon Univ., Korea, Republic of

[2]Gachon University, Korea, Republic of

Tungsten diselenide(WSe2) and tungsten disulfide(WS2) have been widely used as a two-dimensioanl(2D) transition metal dichalcogenide(TMDC) material for the p-type channel layer of thin film transistor(TFT) of varoius future electronic devices. The 2D WSe2 and WS2 layers have been mainly obtained using chemical vapor deposition(CVD) and subsequent exfoliation/transfer process. In spite of the high mechanical strengths and high mobilities of CVD-grown WSe2 and WS2 layers, it takes a long time to carry out CVD process at high temperature and it may be so difficult to use the exfoliation/transfer process in terms of mass production in the fabrication of 2D WSe2/WS2 thin films.

In our previous research, WS2 thin films were directly formed on sapphire substrate by radio-frequency(RF) sputtering and high temperature rapid thermal annealing(RTA) from 500 to 800 \'C. Although the sputtered WS2 thin films showed high mobilities for all the process conditions and Raman scattering spectra E1 2g peaks about 350 cm-1 for some special conditons, it is difficult to lower the fabrication cost of WS2 thin films because of the high cost of sapphire substrates. It is necessary to develop a new fabrication process without sapphire substrates.

In this study, WS2 films were deposited on soda-lime glass substrate instead of sapphire substrate by RF sputtering and RTA was carried out at temperatures lower than 600 \'C (from 400 \'C to 550 \'C). The Raman spectra results showed the 2D WS2 films were formed at the higher RF sputering powers as a formation of E1 2g peak and A1 g peak and the X-ray photoelectron spectra(XPS) results also showed more dominant sulfur 2P1/2 and 2P3/2 peaks at a higher RF sputtering power. The structural characteristics showed that 2D WS2 thin films can be directly formed on soda-lime glass substrates.

This work was supported by the Industrial Human Resources and SkillDevelopment Program (N0001415, Display Expert Training Project for AdvancedDisplay Equipments and Components Engineers) funded by the Ministry of Trade, Industry,and Energy (MOTIE, Korea).