Development of technologies for producing Gallium oxide thin films

Luka Orvelashvili[1], Amiran Bibilashvili[1,2]

Email: luka.orvelashvili892@ens.tsu.edu.ge

[1]Physics department, Exact and natural sciences
faculty, National university of Ivane Javakhishvili,
3 I. Chavchavadze avenue, Tbilisi 0179, Georgia.
[2]LEPL Institute of Micro and Nanoelectronics,
13 I. Chavchavadze Avenue,Tbilisi 0179, Georgia.

Improving the performance of components in functional communication systems requires either enhancing the quality of the materials used or developing new materials with better parameters. In this regard, both fundamental and applied scientific fields anticipate the introduction of Gallium oxide (Ga_2O_3) into nanotechnology as a new-generation, promising semiconductor material.

This thesis discusses the low-temperature magnetron sputtering technological process for the formation of gallium oxide films. The film deposition was carried out on silicon and sapphire substates to perform measurements of various oxide parameters. The Kinetics of film formation was analyzed, the objectives were outlined, and the individual technological processes were discussed in detail. Optimal processes of film formation were determined. The electro-physical, dielectric, and optical parameters of the obtained oxide films were studied, including film thickness, surface roughness, work function, and X-ray structural analysis. The current-voltage characteristics of the memristor were also measured. A technological route was developed for the use of the film as an active layer in a memristor. Optimal parameters for gallium oxide film formation were established. The measurement results were summarized, demonstrating that the oxide films obtained using this technology are of high quality and can potentially be used in the production of micro and nano-electronic devices.