FABRICATION AND STUDY OF BST-BASED FUNCTIONAL MATERIALS

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Introduction

The objective of the monograph *Fabrication and Study of BST-based Functional Materials* is to review the results of theoretical approaches and original experimental investigations carried out by the author and related to the synthesis, structure and properties of barium strontium titanate thin films grown by sol-gel technique on stainless steel substrates.

The subject is varied, covering many important, sophisticated, and practical areas, which are built upon the same foundation. I have attempted to present this complex subject matter by emphasizing the scientific and technological ideas in order to give an understanding of the physical phenomena, thin film processing and practical areas of thin film application.

The stages of investigation devoted to the improvement of the technology of BST thin film fabrication by means of sol-gel method are given. Investigation into their structure, microstructure, and basic dielectric, ferroelectric, and optical properties as well as the application of the grown BST thin films in the construction of voltage tunable microwave devices are presented in the monograph. Due to the material used as the thin film substrates (i.e., stainless steel) and the specificity of the "substrate-thin film" system, the suitable technological conditions of the thin film growth have been worked out, specific experimental attachments necessary to provide adequate technological conditions have been designed and new methods of measurement and experimental measuring systems have been developed.

Results of investigations on BST thin films and the analysis presented in the current monograph include research in the field of material science, structural analysis, spectroscopy and mathematical modelling. The developed technology of BST thin film synthesis by sol-gel method afford possibilities for application of synthesized thin films for construction of ferroelectric tunable devices.

The main subjects covered in the present monograph are organised as follows:

Chapter 1 describes functional materials and discusses the problem of materials smartness.

Chapter 2 considers structure, compositional modifications and properties of $BaTiO_3$ and $BaTiO_3$–$SrTiO_3$ solid solution on the basis of the current theoretical and experimental data.

Chapter 3 discusses the state-of-the-art in the field of the thin film technology including the reasons for increasing importance of ferroelectric thin films, and presents a brief description of various deposition techniques applied to produce ferroelectric films.

Chapter 4 presents original results obtained by the author on developing the BST thin film technology. The methods of investigation into the physical properties of the BST thin films are presented and the main experimental results on: thermal analysis, crystal structure, phase composition, microstructure, as well as optical, nano-mechanical, piezoelectric and dielectric properties of the grown BST thin films are brought together.

Chapter 5 covers the subject of the application of BST-based thin films. An emphasis is laid on the application in microwave electronics.

References are given in the order of appearance in the main text.

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