Karlsruhe Institute of Technology

Karlsruhe Institute of Technology (KIT), Campus North
Institute for Applied Materials- Material Process Technology
Hermann-von-Helmholtz-Platz 1,
D-76344 Eggenstein-Leopoldshafen, Germany

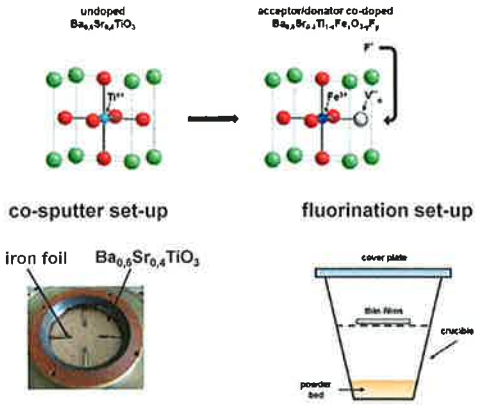
XPS characterization of iron/fluorine co-doped BST thin films for tunable microwave applications

F. Stemme, H. Geßwein, J. R. Binder and M. Bruns

Introduction

Barium strontium titanate (BST) is a very promising material for tunable microwave applications like phase-shifters and tuneable filters. In recent years, therefore, the influence of e.g. annealing conditions and processes on thin film properties and their dielectric performance were largely investigated. However, only a few groups have tried to tune the properties of sputtered BST thin films using different dopants, like iron and fluorine, simultaneously.
Such co-doped thin films can be achieved by RF magnetron sputtering, using a co-sputter target [1, 2] and a subsequent two-step annealing process. The first annealing process provides the crystallinity of the films. In the second annealing process the fluorine co-dopant is introduced into the BST thin films by a diffusion controlled process.

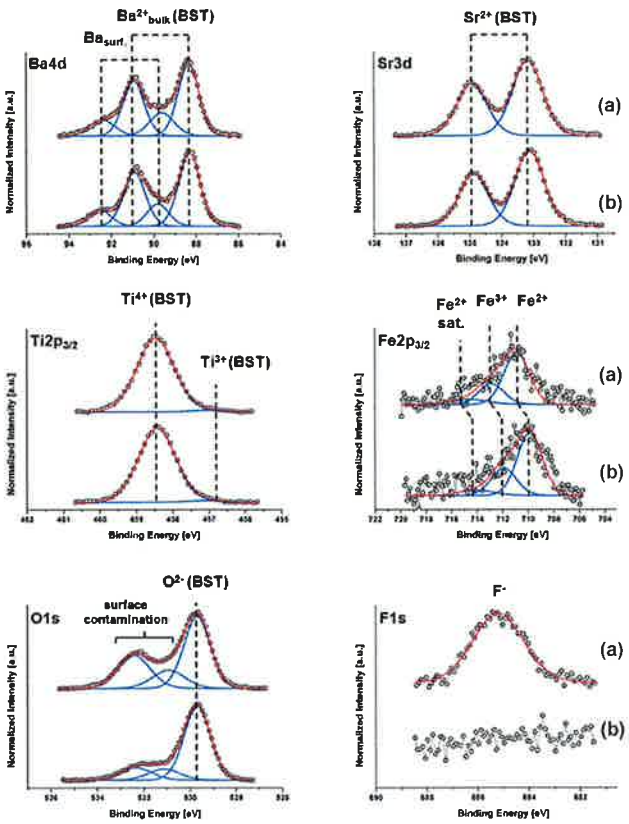
Principles of co-doping



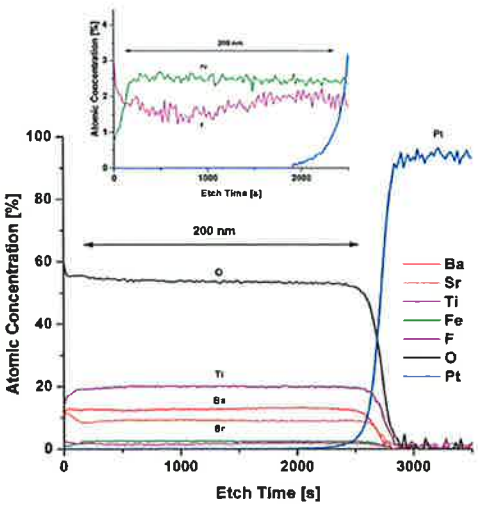
Results

K-Alpha Spectrometer ThermoFisher Scientific

Surface elemental composition



Elemental distribution in the BST thin film



Conclusion

- Binding energy shift of the iron dopant in the fluorinated sample is a first indicator for the incorporation of fluorine in the crystal structure
- Homogeneous dopant distribution troughout the film thickness
- Validation of the co-doping process as a suitable way for achieving iron/fluorine co-doped BST

1. F. Stemme et al., Anal. Bioanal. Chem., 403 (2012) 643-650
2. F. Stemme et al., J. Mater. Sci., 47 (2012) 6929-6938