Determination and Analysis of Diffusion of Metals in PZT

M. Arar[1], D.Schütz[1], C. Kurta[2], W. Sprengel[3] and K. Reichmann[1]
[1]Graz University of Technology, CD-Laboratory for Advanced Ferroic Oxides, Stremayrgasse 16, 8010 Graz, Austria
[2]Karl-Franzens-University Graz, Institute of Chemistry – Analytical Chemistry, Unversitaetsplatz 1, 8010 Graz, Austria
[3] Graz University of Technology, Institute of Materials Physics, Petersgasse 16, 8010 Graz, Austria

E-mail: mario.arar@tugraz.at

Multilayer ceramic components are occupying a growing market. Not only as multilayer ceramic capacitors and varistors, but also as piezoelectric actuators in fuel injector systems for diesel engines, for precision positioning on short time scales e.g. in zoom lenses for digital cameras, and many other fields where performance, yield, and reliability as well as low manufacturing costs are necessary.

Such components of this type consist of green ceramic tapes with thick film metal paste acting as inner electrode applied by screen-printing. After stacking and pressing they undergo thermal processing, which includes debindering and sintering, where temperatures above 1000°C are prevailing [1].

In general such devices can be regarded as a layered ceramic-metal composite, where chemical reactions and interdiffusion are taking place during the thermal processing, influencing densification and microstructure as well as electrical properties of the materials. Details of the occurring reactions concerning each participating material have been investigated thoroughly in the past for a number of materials, but investigations on the interaction of ceramics and electrodes pose a challenge to analytical techniques [2, 3].

In the present work we have chosen lead-zirconate-titanate (PZT) and silver-palladium alloy as a model system for demonstrating the ability of Laser Ablation combined with Inductively Coupled Plasma Mass Spectroscopy (LA-ICPMS), a modern technique with high sensitivity and resolution over a long range, for the investigation of concentration profiles [4].

The capability of LA-ICPMS to obtain spatial information at trace element levels allows for distinguishing and quantifying of the different processes involved.

References

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