Sonderforschungsbereich 595
Elektrische Ermüdung in Funktionswerkstoffen

TECHNISCHE UNIVERSITÄT DARMSTADT

Kolloquium SOMMERSEMESTER 2009

09.07.
2009

Prof. Shashank Priya
Materials Science and Engineering, Virginia Tech

Lead-free piezoelectric materials for sensors, capacitors and actuators

This study reviews our progress on investigation of phase transitions, synthesis, and piezoelectric/dielectric properties of various lead-free systems including (1-x)($Na_{0.5}K_{0.5}$)NbO_3-x$BaTiO_3$, (1-x)($Na_{0.5}Bi_{0.5}$)TiO_3-x$BaTiO_3$, and modified $BaTiO_3$ ceramics. In (1-x)($Na_{0.5}K_{0.5}$)NbO_3-x$BaTiO_3$ ceramics, three phase transition regions were observed corresponding to orthorhombic, tetragonal, and cubic phases. The composition 0.95($Na_{0.5}K_{0.5}$)NbO_3-0.05$BaTiO_3$, which lies on boundary of orthorhombic and tetragonal phase, was found to exhibit excellent piezoelectric properties. The properties of this composition were further improved by addition of various additives and understanding the sintering mechanism, making it suitable for multilayer actuator application. A correlation between the nature of polymorphic phase transition and piezoelectric properties was established illustrating the importance of fractional phase ratio. Textured (1-x)($Na_{0.5}Bi_{0.5}$)TiO_3-x$BaTiO_3$ system were investigated to illustrate the domain structure and it's correlation with observed dielectric and piezoelectric properties. Further, a relationship was established between the weight of the perovskite lattice and piezoelectric response in lead-free materials. We have developed a new series of modified $BaTiO_3$ systems exhibiting range of dielectric and piezoelectric properties that could find application in sensors and capacitors.
Acknowledgement: This study was sponsored by Office of Basic Energy Science, Department of Energy, National Science Foundation, and KIMS.

Die Vorträge finden, wenn nicht anders angegeben, jeweils um **16:15** im Gebäude der Materialwissenschaften, Lichtwiese, Petersenstr. 23, **Raum 77** statt