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abstracts

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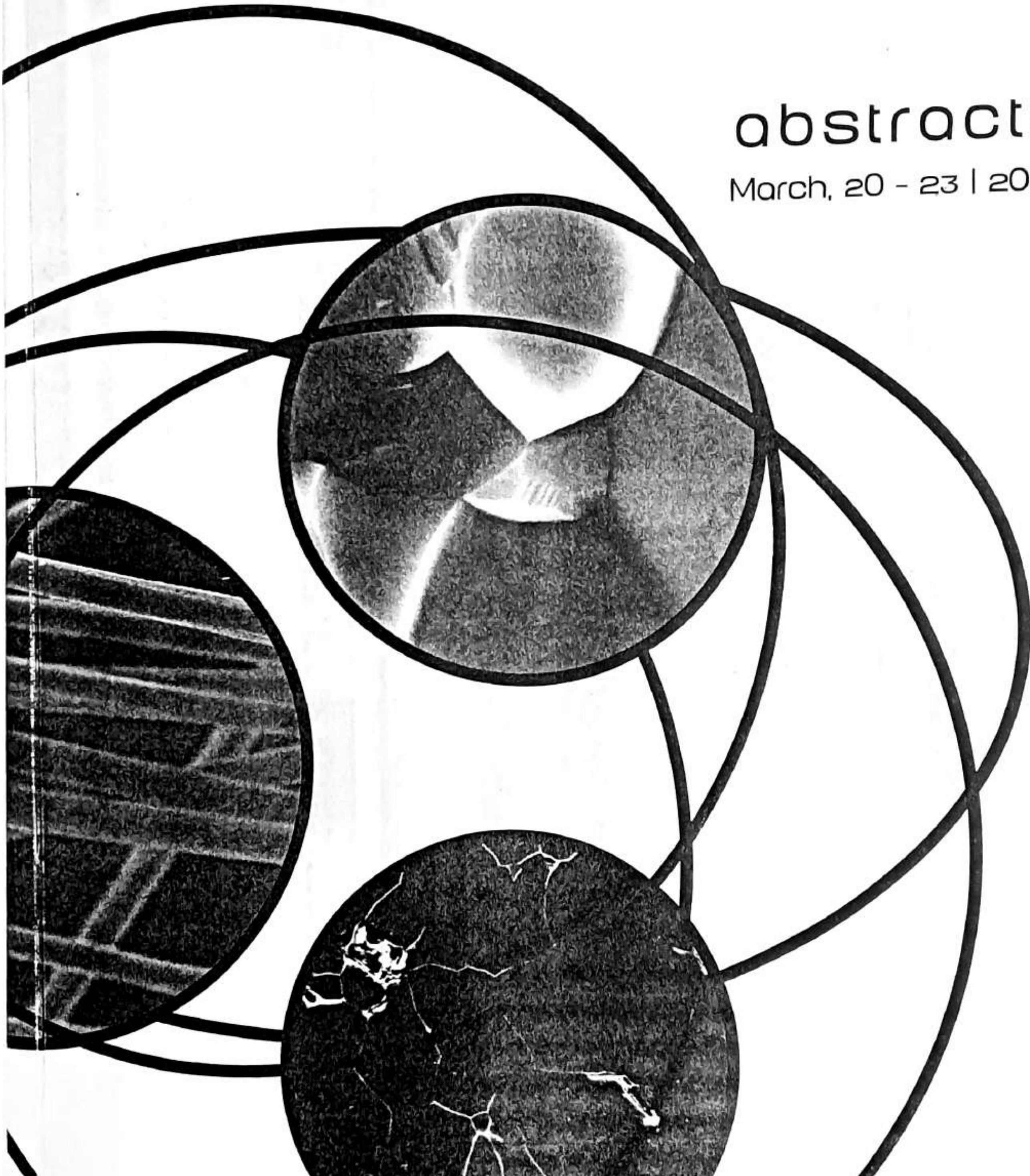

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$Ba_{1-x}Sr_xTiO_3$ (BST) is well known to be a suitable ferroelectric material for tunable GHz-range devices such as microwave resonators, filters and phase shifters [1]. It has been recently shown that the peak value of dielectric permittivity of BST ceramics of the same composition is strongly dependent on their average grain size, while both the tetragonality ratio and the Curie temperature are not affected by their microstructure [2]. In this work, the effect of the microstructure on the dielectric response of BST ceramics of several compositions is investigated via conventional dielectric spectroscopy technique complemented with local electromechanical characterization using piezoresponse force microscopy (PFM).

BST ceramics were processed from powders obtained by a citrate-based chemical route. Samples with compositions x = 0.20 and 0.25 were sintered at temperatures varying from 1350 to 1450 °C for 2 hours. Average grain size of the ceramics was found to increase as the sintering temperature is increased. Their dielectric permittivity and loss were measured as a function of temperature in the range 10^2-10^6 Hz. The peak value of the permittivity of the ceramics with x = 0.25 sintered at 1450 °C was found to be about 25% higher than that of the ceramics sintered at 1350°C.

PFM observations revealed the direct correlation between the domain patterns and microstructure. While small grains (less than 1 μm) consist of several domains or are even mono-domain, in big grains well developed pattern including large number of 180- and 90-degree domain walls was observed. Therefore, the reduction in the permittivity value found in ceramics sintered at low temperature is explained in terms of a smaller extrinsic contribution (related to domain wall motion) to the dielectric permittivity.

Evolution of both the domain structure and the local piezoresponse near the phase transition was analyzed. Residual piezoresponse was found to remain above the macroscopic Curie temperature.

[1] A.K. Tagantsev et al., *J. Electroceramics*, 11 (2003) 5.
[2] J.-H. Jeon, *J. Eur. Ceram. Soc.*, 24 (2004) 1045.

T09.P7 The ion conducting properties of perovskite-type solid solutions $(La_{0.5}Li_{0.5})[Ti_{1-x}(M_{0.5}Nb_{0.5})x]O_3$ (M = Al, Ga)

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High lithium conducting perovskite oxides attract great attention due to wide prospects of applications.

In this work, the influence of the B-site substitution for Ti on the conducting properties of new perovskite solid solutions $(La_{0.5}Li_{0.5})[Ti_{1-x}(M_{0.5}Nb_{0.5})_x]O_3$ with M = Al (I), Ga (II); x = 0-1.0 has been studied.

Ceramic solid solutions have been prepared by the solid state reaction method. The samples have been studied by the X-ray diffraction, DTA/DTG, dilatometry, electron microscopy, IR- and dielectric spectroscopy methods.

The tetragonal perovskite solid solutions have been obtained in the range of x = 0-0.4 (I) and x = 0-0.3 (II). The unit cell volume has been found to decrease with x growth in the system I, while it increases in solid solutions II in accordance with the average ionic radii changes.

The temperature behavior of conductivity follows the Arrhenius' law at temperatures higher than 400 K for all the samples studied. The deterioration of the conductive properties of ceramics I with x increasing has been observed, that is a consequence of the structural "bottleneck" dimensions decrease due to the unit cell contraction along with the contribution of the impurity phases.

In the range of 500 - 1000 K, anomalies on the temperature dependences of dielectric permittivity and dielectric losses have been revealed. The connection of the high temperature anomalies with the structural transitions has been confirmed by the DTA and dilatometry methods.

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T09.P8 In situ cure monitoring of composite laminated using fibre bragg grating sensors

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This work presents the cure monitoring of composite laminated using fibre Bragg grating (FBG) sensors. For real-time monitoring of cure unidirectional composite laminated (CFRP – Carbon Fibre Reinforced Plastic) fabricated using the hot plate press, two in-line FBGs were embedded to perform the real time measurement of temperature and strain. In order to discriminate these two physical parameters by using the matricial method, the two FBGs were written in Boron and Germanium doped optical fibres, which allows obtaining different temperature sensitivities but similar strain sensitivities. The closing of the hot-press is detected by the FBG sensors and occurs at approximately 100 °C. Also, the exothermic peak appeared at 130 °C and the temperature of the stabilization phase was set at 125 °C. Additional work is under way to optimize this embedded monitoring process.

T09.P9 Transient heating of thermal protection systems: experiments and simulations

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Thermal Protection Systems (TPS), used for space re-entry vehicles, are increasingly required and the exploitation of the characteristics of ceramic refractory materials often depends on the capability to join ceramics to other materials or to produce peculiar Functionally Graded Materials (FGMs).

Experimental tests and numerical simulations are necessary to study the thermal insulating behavior of TPS and in this work two different kinds of TPS have been chosen:

- three-layer ZrB_2/Ag-Zr/TiAlV joined sample,
- FGMs (Ti, Zr and Hf borides)/(NiAl) produced by Combustion Synthesis .

The boride side was heated by laser radiant energy (solid state or CO_2 lasers) and the temperature histories of the sample ends were measured by two 50 mm type S thermocouples in contact to each face.

The sample was positioned in contact with an insulating material on the metal side, to minimize the pellet heat loss by conduction or with a metallic plate to exchange heat at the cold end. Typical results, obtained by this procedure are two temperature profiles describing the heating histories of the two sample sides.

The 1-D numerical simulation of transient heating is based on the assumption that the energy input is provided through one of the wall external surfaces and by modeling the heat transfer mechanism such as convection and /or laser irradiation. Moreover, temperature dependence on time may also be accounted for and imposed as boundary condition. At the opposite wall surface (cold boundary), conditions ranging from the isothermal to the adiabatic one can be set.

The thermo-physical properties are given as either constant or temperature dependent functions and the comparisons between experimental and computed temperature profiles allow to determine these parameters and especially the dependence on temperature of the thermal conductivity.