Lithium tetraborate attracts considerable interest in nonlinear optics as an element of surface acoustic wave devices, a frequency-conversion material for 2nd-5th harmonic generation from a high-power Nd:YAG laser, as a high power ultraviolet light source based on SHG and SFH of the visible laser radiation *etc*. Possible applications for $Li_2B_4O_7$ require deeper understanding of its properties, especially at non-ambient conditions.

Thus in the literature there is plenty of controversial data on $Li_2B_4O_7$ reporting anomalous behaviour in the different temperature ranges, e.g. thermal scintillations have been observed in $Li_2B_4O_7$ when not excited by hard quanta [2], incommensurate structure modulation [3], anomalies in thermal expansion and thermal evolution of bond lengths [4, 5], numerous phase transitions [6, 7], anomalies in sound velocities and Raman spectra [8], strong anisotropy of ionic conductivity [9] *etc*. The existing discrepancies between the experimental results of different authors lead us to perform systematic studies of lithium tetraborate.

Structural studies were performed using coherent elastic neutron scattering on ^{11}B enriched $Li_2B_4O_7$ (99.6% ^{11}B). Powder diffraction examinations unambiguously indicated isostructurality of $Li_2B_4O_7$ structure type in the temperature range from 3 K to its melting point at ca. 1170 K. Despite this fact, an evidence for anomalies in thermal dependencies of lattice parameters, bond lengths and displacement parameters has been deduced.

In the current contribution we report on complex studies of lithium tetraborate doped with ^{11}B in the broad temperature range 3-1200 K using neutron powder/single crystal diffraction, dilatometry, specific heat, calorimetry and impedance spectroscopy together with an attempt to present our view on the nature and origin of anomalies in $Li_2B_4O_7$.

[1] Krogh-Moe J., *Acta Cryst. B*, 1962, 15, 190. [2] Antonyak O. T. et al., Optika i Spektroskopiya, 1986, 61, 550. [3] Zhigadlo N.D., *Phys. Stat. Sol. (a)*, 1995, 152, 329. [4] Adamiv V.T. et al., *J. All. Compd.* (in print). [5] Sennova N. et al., *Z. Anorg. Allg. Chemie*, 2008, 634, 2601. [6] Techanovich N. P. et al., Phys. Sol. State 1990, 32, 2513. [7] Borman K. Ya. et al., *Current Problems in Physics and Chemistry of Ferroelectrics, Riga* 1987 (p. 140). [8] Sehery A. A. and Somerford D. J., *J. Phys.: Condens. Matter* 1989, 1, 2279. [9] Furusava S. et al., *J. Pys. Soc. Jap.* 1990, 59, 2532.

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Structural, magnetic, electrical and magnetocaloric properties in $Pr_{0.6}Sr_{0.4}MnO_3/BaTiO_3$ composites.

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Composites with varying composition of ferromagnetic $Pr_{0.6}Sr_{0.4}MnO_3$ and ferroelectric $BaTiO_3$ have been prepared using a solid-state ceramic method $(1-x)(Pr_{0.6}Sr_{0.4}MnO_3)/x(BaTiO_3)$, with x is the molar ratio and x = 0.0, 0.03, 0.05, 0.10 and 0.30 using conventional ceramic double sintering process. We report the structural, magnetic electrical and magnetocalorical properties of all samples. The presence of the two phases of $Pr_{0.6}Sr_{0.4}MnO_3$ (PSMO) and $BaTiO_3$ (BTO) was confirmed by X-ray diffraction (XRD) technique and the structural analysis. Magnetic measurements of magnetization versus temperature and applied field were performed. The temperature dependence of magnetization reveals that the composite samples show paramagnetic to ferromagnetic transition when the temperature decreases at the same Curie temperature as the parent PSMO compound ($T_c \approx 273K$). The magnetic entropy change $\left|\Delta S_M\right|$ has been deduced from the M(H) data by the Maxwell relation. Close to T_c, large change in magnetic entropy has been observed in all samples. The maximum value of the magnetic entropy is $\left|\Delta S_M^{max}\right|$ decreases from 2.88 $J.kg^{-1}.K^{-1}$ for x = 0 to 1.86 $J.kg^{-1}.K^{-1}$ for x = 0.3 for an applied magnetic field of 2T. At this value of magnetic field the relative cooling power (RCP) decreases also from 63 $J.kg^{-1}$ for the parent sample to 38.3 $J.kg^{-1}$ for x = 0.3. The temperature dependence of the Landau coefficients have been deduced using the Landau expansion of the magnetic free energy, indicating the second order nature of the magnetic transition.

[1] G. M. Ren, S. L. Yuan, H. G. Guan, X. Xiao, G. Q. Yu, J. H. Miao, Y.Q. Wang, S. Y. Yin, Mater Lett 61 (2007) 767. [2] E. Bose, S. Tarana, S. Karmakara, B. K. Chaudhuri, S. Pal, C.P. Sun, H.D. Yang, J. M. M. M 314 (2007) 30.

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Twin structure and conductivity in LSGM.

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The aim of our investigations was to study the arrangement and distribution of twin boundaries during mechanical and thermal treatment in order to examine reversibility phenomena in larger ferroelastic crystal plates (5x6x0.87 mm^3) as well as the influence of the domain structure on ionic conductivity. In a selected $La_{0.95}Sr_{0.05}Ga_{0.9}Mg_{0.1}O_{3-x}$ (LSGM) - crystal plate the submicron twin structure was studied using white synchrotron radiation at the Kappa-diffractometer F1 equipped with a MAR CCD-detector (HASYLAB, DESY). Scanning of the sample under the beam (0.05x0.05mm^2) and collecting diffraction data at each step with 45 micron spatial resolution was used to map the domain pattern in the LSGM-plate after mechanical and thermal treatment. Conductivity measurements were done between ~ 70 °C and 710 °C in air. Impedance spectroscopy was applied using a HP4284 LCR-meter in the range 20 Hz – 1 MHz. Data were recorded applying AC amplitudes of 80 mV and 1V to the electrode.

It was shown that before mechanical treatment mainly twin walls normal to the largest surface of the plate occurred. The observed domain structure was partially switched to another twin configuration with domain walls parallel to the surface or to certain domain states during polishing. After annealing the domain configuration with prevalent domain walls normal to the largest plate surface was fully restored.

Impedance plots show two semicircular arcs. The first high frequency arc corresponds to the bulk conductivity while the second low frequency one corresponds to the conductivity on domain boundaries.

Our results show that strain can relax completely by forming