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BOOK of ABSTRACTS

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Multicaloric Efficiency of Ferroelectric-Ferromagnetic Volume Composites (x)$La_{0.7}Pb_{0.3}MnO_3$ - (1-x)$PbTiO_3$

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In the recent studies of magneto(MCE)- and baro(BCE)-caloric effects in ferromagnet $La_{0.7}Pb_{0.3}MnO_3$ [1] and electrocaloric effect (ECE) and BCE in ferroelectric $PbTiO_3$ [2] we have shown that caloric efficiency of monoferroic materials can be elevated using two from three distinct external fields (electric, magnetic, mechanical stress). Such a way is promising also for multiferroic materials involving two or even three subsystems characterized by different ferroic nature (ferroelectric, ferromagnetic, ferroelastic). In single-phase materials, magnetoelectric, magnetoelastic or electroelastic coupling arises directly between the two order parameters. On the other hand, the interaction between two monoferroic phases can be enhanced through their strain-mediated indirect coupling in composites. In such materials, the electric, magnetic and elastic order parameters arise in separate but intimately connected phases.

In the present paper, volumetric ferromagnet - ferroelectric composites (x)$La_{0.7}Pb_{0.3}MnO_3$ - (1–x)$PbTiO_3$ with x=0.85 and x=0.18 were prepared. For all samples there was obtained the detailed experimental information on MCE, BCE, magnetization, heat capacity, entropy, thermal dilatation, susceptibility to hydrostatic pressure. Multicaloric efficiency of composites is discussed and compared with that of initial $La_{0.7}Pb_{0.3}MnO_3$ and $PbTiO_3$ compounds. Variation of a relationship between components can significantly increase both barocaloric and magnetocaloric efficiency of compositional material due to the mechanical stress appearing between grains of different ferroic phases under magnetic field.

The results obtained allow us to suppose that ferromagnetic–ferroelectric composites are really promising materials for their use as effective solid-state refrigerants in magnetic as well as multicaloric cooling cycles built on MCE and BCE.

References:

1. Kartashev A.V., Mikhaleva E.A. et al. J. Appl. Phys. **113**, 073901 (2013).
2. Mikhaleva E.A., Flerov I.N et al. Physics of the Solid State. **54**, 1832 (2012).