Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Super-pyroelectric effect in nanocrystalline films of BaTiO3 with macro-domain organization YAHIN YVRY, VERA LYAHOVITSKAYA, Weizmann Institute of Science, Israel, ILYA ZON, IGOR LUBOMIRSKY, Weizmann Institute of Science,Israel, ALEXANDER ROYTBURD, University of Maryland, USA — Self-supported films of nanocrystalline BaTiO3 exhibit an earlier unreported phenomenon: orders of magnitude increase of pyroelectric effect ("super-pyroelectricity"). The measured value ($\sim 1\mu$C/(cm2·K)) is one the highest ever reported for ferroelectric materials. The super-pyroelectricity arises due to self-organization of hundreds of millions nanocrystalline ferroelectric grains in macro-domains: the regions where directions of the crystallographic axes are strongly correlated. Small temperature variations cause reversible changes in the direction of spontaneous polarization of ferroelectric grains in macro-domains producing gigantic pyroelectric current. In contrast to regular pyroelectricity observed in ferroelectrics, super-pyroelectric effect reaches maximum at 80-100 K below the temperature of the para-to-ferroelectric phase transition. This work demonstrates that polycrystalline macro-domains are capable of fast (<10 μsec!) and reversible adaptation to minute changes of external conditions, which promises creation of pyroelectric and piezoelectric devices with previously unattainable performance.

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Date submitted: 11 Dec 2006 Electronic form version 1.4