Ferroelectric leverages for solid state cooling

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The search for alternative solid-state refrigeration materials to hazardous gases in conventional and cryogenic cooling devices is a very active field of condensed matter [1,2]. The use of phase transitions is a powerful tool to achieve giant caloric effects in ferroic materials in which magnetization, polarization, strain and/or volume can be strongly tuned under a moderate external stimulus. Here, we explored various aspects of ferroelectrics to reveal their potentialities as solid state coolers such as the ferroeletrci phase transitions, the multiphase points composition, the stress-sensitivity through elasto- and baro-caloric responses, the inverse electrocaloric effect evidenced for instance in antiferroelectrics, the asymmetric effect arising from non-ergodic states, the use of dual-stimuli by taking advantage of multicaloric effects combining stress and electric field in ferroelectrics or magnetic and electric fields in multiferroics, as well as the use of defects [3-12].

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