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Next Generation Electrocaloric and Pyroelectric Materials for Solid State Electrothermal Interconversion S. PAMIR ALPAY, University of Connecticut - Storrs, JOSEPH V. MANTESE, United Technologies Research Center, SUSAN TROLIER-MCKINSTRY, QIMING ZHANG, Penn State University, ROGER W. WHATMORE, Imperial College London — Thin film electrocaloric (EC) and pyroelectric (PE) electrothermal interconversion energy sources have recently emerged as viable means for primary and auxiliary solid state cooling and power generation. This emergence is a result of two significant developments: (1) advancements in the formation of high quality polymeric and ceramic thin films with figures of merit that project system level performance as a large percentage of Carnot efficiency, and (2) the ability of these newer materials to support larger electric fields which permit operation at higher voltage; thus making the power electronic architectures more favorable for thermal to electric interconversion. Current research targets to adequately address commercial device needs, include reduction of parasitic losses, increases in mechanical robustness, and the ability to form nearly free-standing element in the range of 1 - 10 microns in thickness. This article will describe the current state-of-the-art materials, thermodynamic cycles and device losses; pointing to potential lines of research that would lead to substantially better figures of merit for electrothermal interconversion.

S. Pamir Alpay
University of Connecticut - Storrs

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