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Title:	Irreversible thermodynamics of thermoelectric devices: from local framework to global description
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Keywords:	thermoelectric devices thermodynamics
Issue Date:	2021
Publisher:	IOP Publishing
Citation:	Journal of Statistical Mechanics: Theory and Experiment, 2021(7)
Abstract:	Thermoelectricity is traditionally explained via Onsager's irreversible, flux–force framework. The coupled flows of heat and electric charge are modeled as steady-state flows, driven by the thermodynamic forces defined in terms of the gradients of local, intensive parameters like temperature and electrochemical potential. We analyze the thermodynamics of thermoelectricity in terms of global flux–force relations. These relations clearly show the additional quadratic dependence of the driver flux on global forces, corresponding to the process of Joule heating. We discuss the global kinetic coefficients defined by these flux–force relations and prove that the equality of the global cross-coefficients is derived from a similar property of the local coefficients. Further, alternate choices for the thermal flux appearing in the rate of entropy production, also lead to the reciprocity of global coefficients. Finally, we clarify the differences between the global framework for thermoelectric energy conversion and the recently proposed minimally nonlinear irreversible thermodynamic model.
Description:	Only IISERM authors are available in the record.
URI:	https://doi.org/10.1088/1742-5468/ac0f68 (https://doi.org/10.1088/1742-5468/ac0f68) http://hdl.handle.net/123456789/4625 (http://hdl.handle.net/123456789/4625)
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