

Finite-time thermodynamics of thermomagnetic generation

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Energy harvesting systems based on thermomagnetic generation (TMG) are experiencing a revival, after more than a century since Tesla patent [1] and nearly seventy years since Brillouin and Isjkenderian paper [2]. This is mainly due to the opportunities opened by the properties of new magnetocaloric materials (MCM), to design more efficient energy-conversion devices [3, 4, 5]. So far most of the thermodynamic studies devoted to the thermodynamics of MCM based TMG systems are focused on the achievable efficiencies using different materials as working substance [3, 6]. Curiously enough no much attention has been devoted to the related efficiency at maximum power (EMP). Here we shall discuss TMG thermodynamic cycles using the classical Cruzon-Ahlborn approach [7] where finite-time heat exchanges are considered on an endoreversible engine (i.e. all the other irreversible processes are neglected). The main advantage of this approach is that it allows to define an EMP upper bound based on a very general, nearly universal expression [8]. In this frame we shall discuss our recent results [9] showing the influence of the material equation of state on thermodynamic cycle shapes.

References

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