

Thermoelectric Efficiency and Compatibility

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The intensive reduced efficiency and compatibility factor is derived for thermoelectric power generation. The overall efficiency is derivable from a thermodynamic state function of two variables, the relative current density and temperature. The method described not only allows the straightforward computation and optimization of efficiency but also clarifies much of the fundamental physics behind thermoelectric devices. Specifically, it reveals a new materials property which we call the compatibility factor. Materials with dissimilar compatibility factors can not be combined by segmentation into an efficient thermoelectric generator because of constraints imposed on the relative current density. Thus, control of the compatibility factor is, in addition to z , essential for efficient operation of a thermoelectric device. The increased understanding of efficiency and compatibility will enable rational materials selection, device design and the engineering of functionally graded materials.

Technical Topic Category: **B1 Theory of Thermoelectricity**
Presentation preference: **Oral**

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