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Demonstration of Scalable Nernst Voltage in a Coiled Galfenol Wire EMILIO CODECIDO, ZIHAO YANG, JASON MARQUEZ, YUANHUA ZHENG, JOSEPH HEREMANS, ROBERTO MYERS, The Ohio State University
— Transverse thermopower by the Nernst effect is usually considered far too weak an effect for waste heat recovery and power generation. We propose that magnetostriction provides a pathway to enhance the Nernst effect because it increases phonon and magnon coupling. Here, we measure the Nernst coefficient in the magnetostrictive alloy, Galfenol ($Fe_{0.85}Ga_{0.15}$) and observe an extraordinarily large Nernst coefficient at room temperature of 4 μV/KT. Next we demonstrate a new geometry for efficient and low cost power generation by wrapping Galfenol wire around a hot cylinder. This coil geometry results in a radial temperature gradient direction. With a magnetic field applied in the axial direction, a uniform Nernst electric field is produced along the azimuthal direction at every point along the coil. As a result of this geometry, the Nernst voltage is shown to increase linearly with wire length, proving the concept of scalable Nernst thermal power generation.

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