異方性磁気ペルチェ効果による吸発熱応答のひずみ誘起スイッチング
Strain-induced switching of cooling-heating generated by anisotropic magneto-Peltier effect

物材機構 [1], 東大物工 [2], 阪大産研 [3], 阪大 CSRN [4], 東北大 CSRN [5], 東北大金研 [6],
○平井 孝昌 [1], セペリアミン ホセイン [1], 長谷川 顕登 [2,3], 小山 知弘 [3,4], 井口 亮 [1],
大久保 忠勝 [1], 千葉 大地 [3,4], 内田 健一 [1,5,6]

NIMS[1], The Univ. of Tokyo[2], ISIR, Osaka Univ.[3], CSRN, Osaka Univ.[4], CSRN, Tohoku Univ.[5], IMR, Tohoku Univ.[6]
○Takamasa Hirai[1], Hossein Sepehri-Amin[1], Kento Hasegawa[2,3], Tomohiro Koyama[3,4], Ryo Iguchi[1],
Tadakatsu Ohkubo[1], Daichi Chiba[3,4], and Ken-ichi Uchida[1,5,6], E-mail:HIRAI.Takamasa@nims.go.jp

Recently, spin-caloritronic effects have attracted great interest from the viewpoints of a simple device structure and unique thermoelectric/thermospin conversion symmetry [1]. Towards future thermal management applications based on such new functionalities in nano-scaled integrated electronic/spintronic devices, it is crucial to improve active control methods and principles for the spin-caloritronic phenomena. In this work, we report mechanical cooling-heating switching of the anisotropic magneto-Peltier effect (AMPE) [2], one of the magneto-thermoelectric conversion phenomena, by applying a tensile strain [3].

We prepared an in-plane magnetized U-shaped Ni film deposited on a polyethylene naphthalate substrate. The AMPE-induced temperature modulation was detected by the lock-in thermography (LIT) at room temperature. Figure 1(a) shows the LIT amplitude (A_{even}) and phase (ϕ_{even}) images showing the AMPE-induced temperature modulation, measured when the magnetic field **H** was applied along the *x* direction. The red (ϕ_{even} ~ 0°) [blue (ϕ_{even} ~ 180°)] region indicates the AMPE-induced temperature increase (decrease), *i.e.*, the heat release (absorption), when the charge current $\mathbf{J}_c$ flows in the direction illustrated in Fig. 1(a). The LIT images under application of a uniaxial tensile strain ε = 1.3% are shown in Fig. 1(b). The sign reversal of the AMPE-induced temperature change is clearly obtained at the corner of the U-shaped Ni sample without adjusting **H** vector. We confirmed that this behavior is due to the strain-induced magnetization rotation via the magneto-elastic coupling in Ni.

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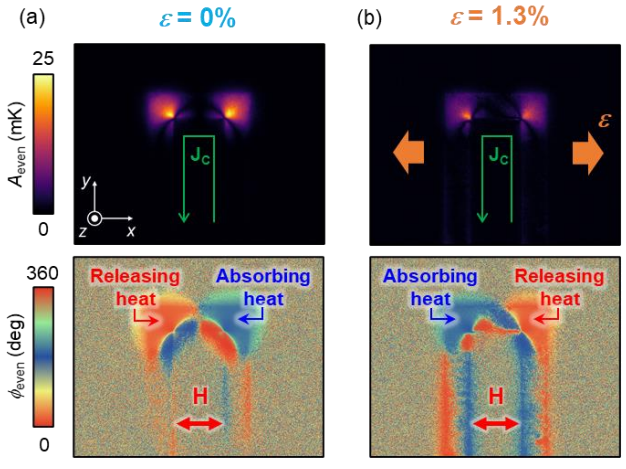

Fig. 1. A_{even} and ϕ_{even} images for (a) ε = 0% and (b) ε = 1.3%.