Supporting Information

Introduction of Ag ions into 2H-$MoTe_2$ via high-pressure diffusion control method

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1. Williamson-Hall plots for the synchrotron XRD patterns

The Williamson-Hall plots were performed for the synchrotron XRD patterns by the following equations.

$$\beta_{\mathrm{T}} \cos\theta = \varepsilon(4\sin\theta) + \frac{K\lambda}{D}$$

where β_{T} is a total broadening (FWHM), ε is a lattice strain, K is a shape factor (= 0.9), λ is a wavelength, and D is a crystallite size. Notably, β_{T} is a sum of the broadenings by crystallite size (β_D (= $K\lambda/D\cos\theta$)) and lattice strain (β_ε (= $4\varepsilon\sin\theta$)), *i.e.* $\beta_{\mathrm{T}} = \beta_D + \beta_\varepsilon$.

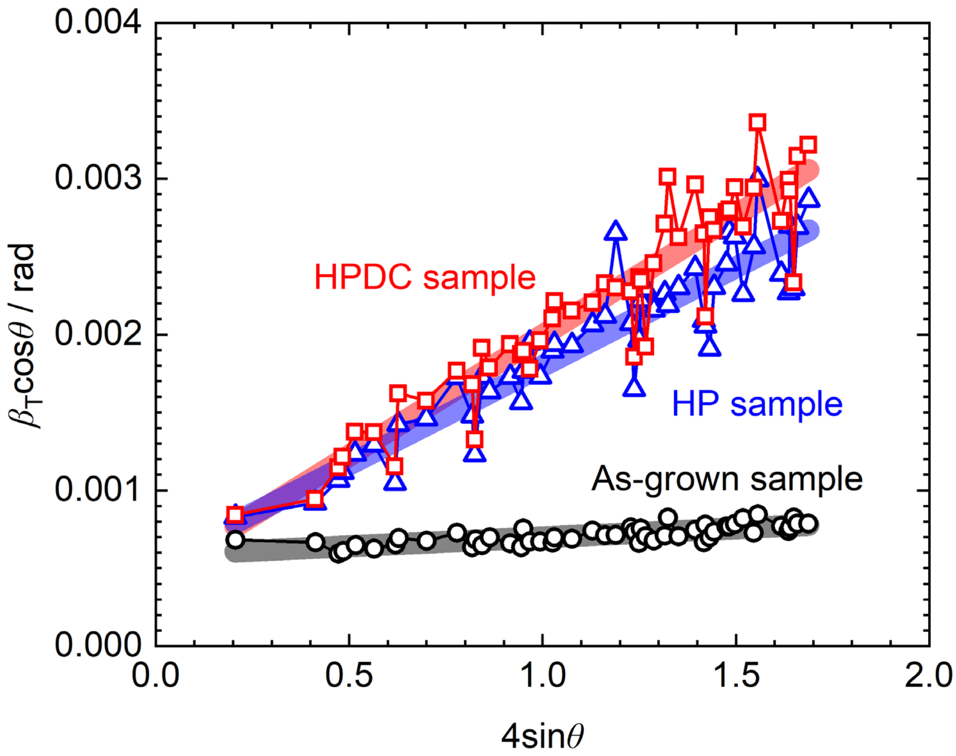

Figure S1. Williamson-Hall plots of the as-grown, HP, and HPDC samples.

Table S1. Summary of crystallite sizes (D) and lattice strains (ε) obtained by the Williamson-Hall plot.

Sample	D / nm	ε
As-grown	111	1.15×10^{-4}
HP	122	1.27×10^{-3}
HPDC	144	1.54×10^{-3}

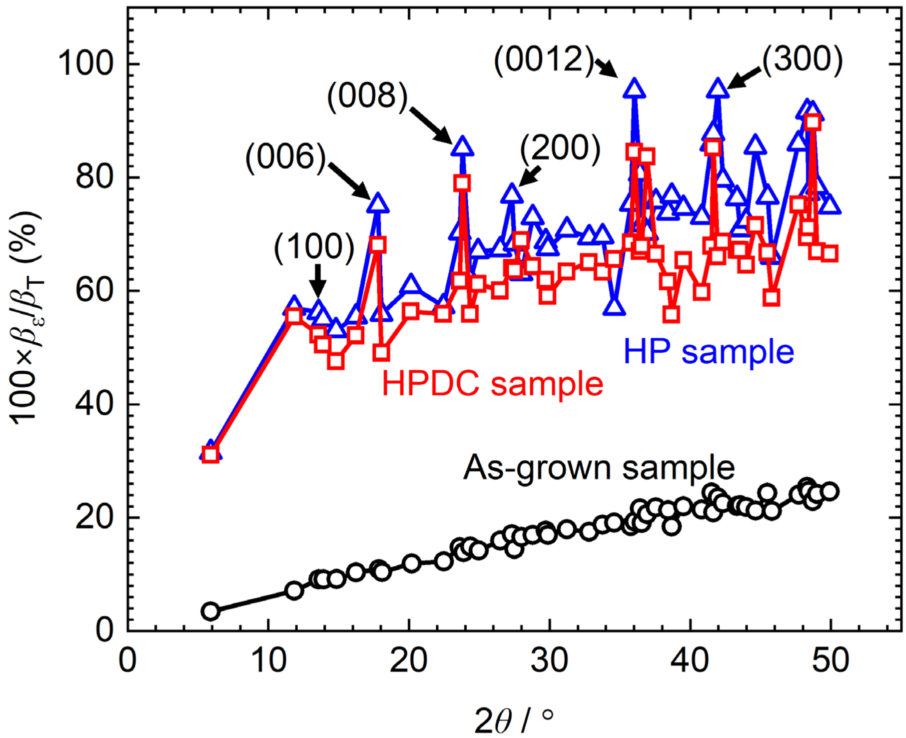

Figure S2. The ratio of broadening by lattice strain to the total broadening for each peak.

2. Current profile during HPDC process

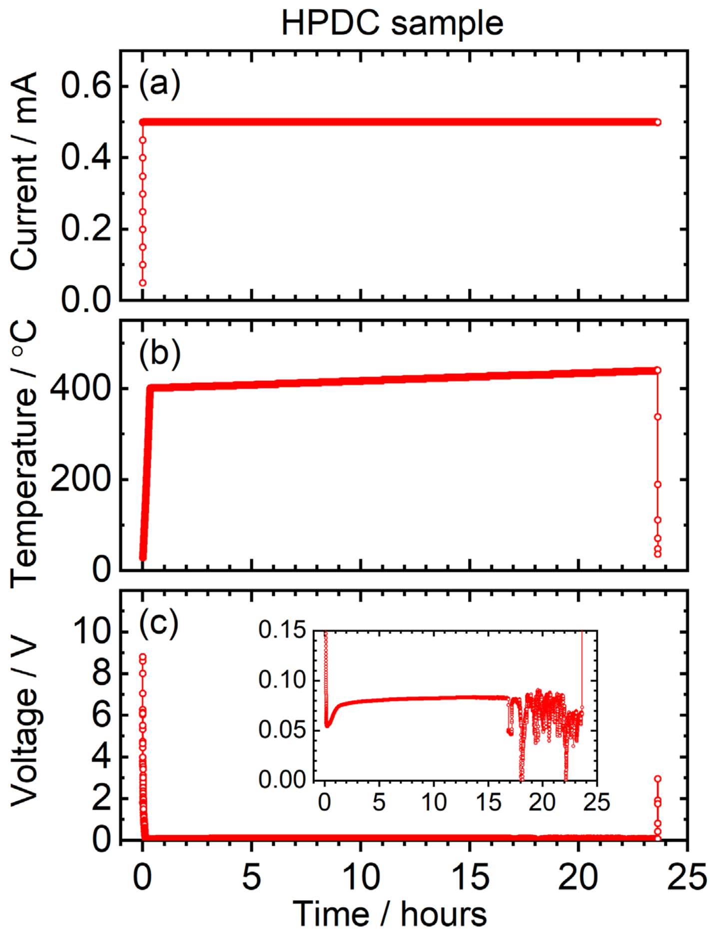

Figure S3. Time dependences of (a) current, (b) temperature, and (c) voltage during the HPDC process.

3. Thermoelectric properties

The Wiedemann-Franz law was applied to calculate the electronic thermal conductivity ($\kappa_{electron}$) using the following equations.

$$\kappa_{electron} = LT\sigma$$

where L, T, and σ are the Lorentz number (= 2.44×10^{-8} V^2K^{-2}), absolute temperature, and electrical conductivity, respectively. Notably, total thermal conductivity is a sum of the lattice thermal conductivity and electrical conductivity, *i.e.* $\kappa_{total} = \kappa_{lattice} + \kappa_{electron}$

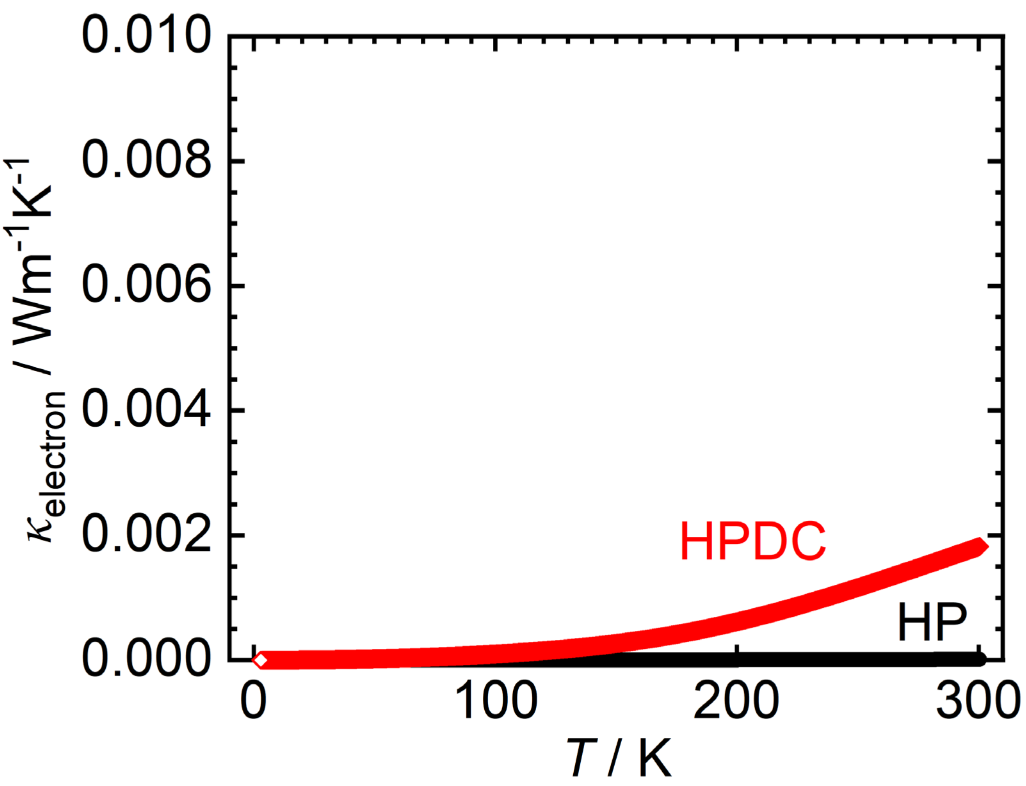

Figure S4. Electronic thermal conductivity ($\kappa_{electron}$) based on the Wiedemann-Franz law.

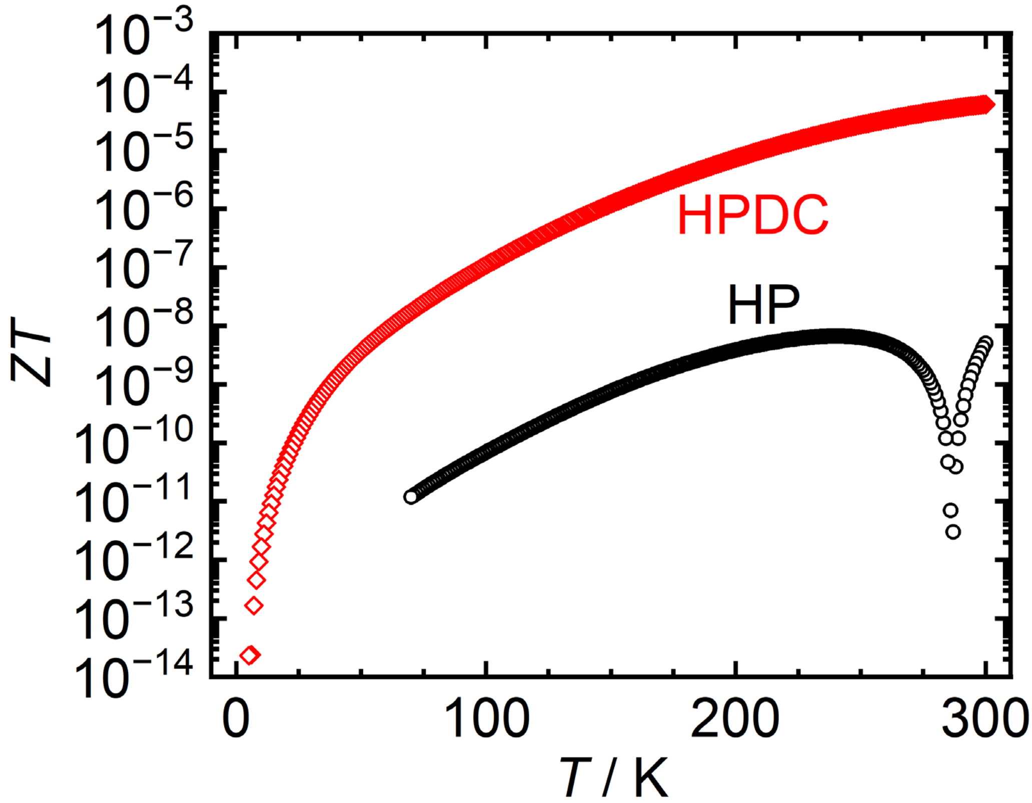

Figure S5. Dimensionless figure of merits (*ZT*) of the HP and HPDC samples.