Electronic Supplementary Information (ESI)

Large Nernst Power Factor over a Broad Temperature Range in Polycrystalline Weyl Semimetal NbP

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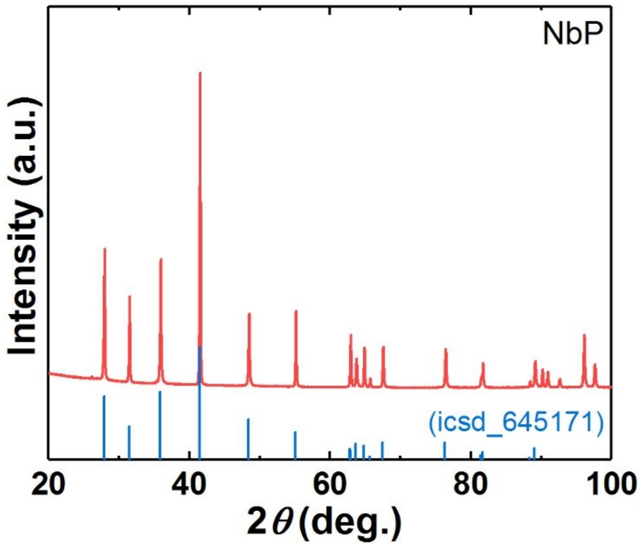

Fig. S1 Powder XRD pattern for NbP with simulated pattern.

Table S1. Relative density of bulk NbP under different sintering temperatures.

Bulk NbP sample	Uniaxial pressure (MPa)	Sintering temperature (°C)	Relative density
S1	80	800	59%
S2	80	920	65%
S3	80	970	71%
S4	80	1150	91%
S5	80	1200	91%

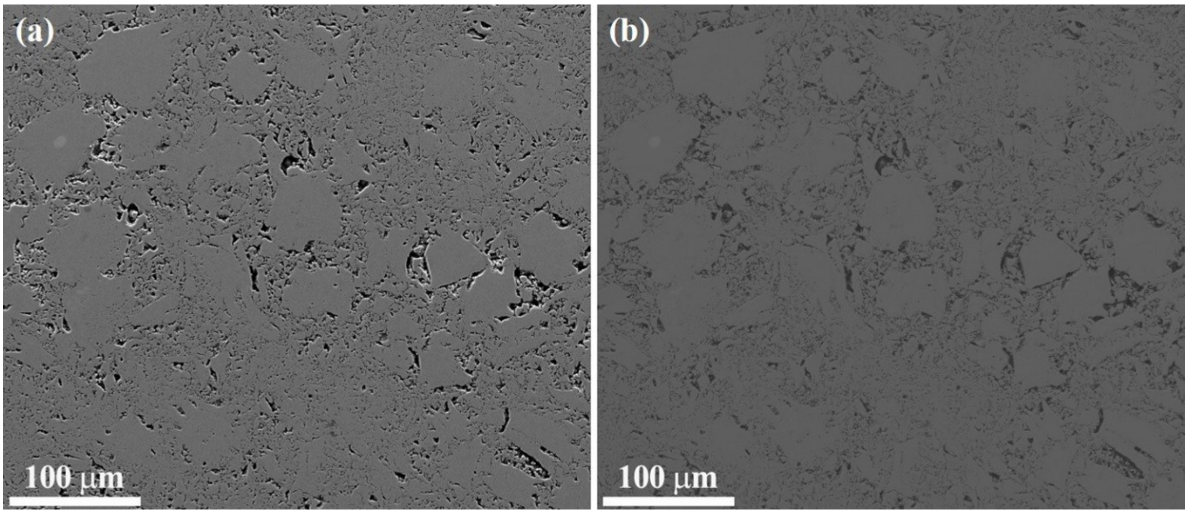

Fig. S2 SEM secondary electron image (a) and back scattered (BS-SEM) image (b) for polycrystalline NbP.

Table S2. Atomic percentage of NbP sample at 8 randomly selected positions detected by Energy-dispersive X-ray spectroscopy (EDX).

element	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8
Nb	49.43%	49.44%	49.73%	49.88%	49.69%	49.47%	49.94%	49.31%
P	50.57%	50.56%	50.27%	50.12%	50.31%	50.53%	50.06%	50.69%

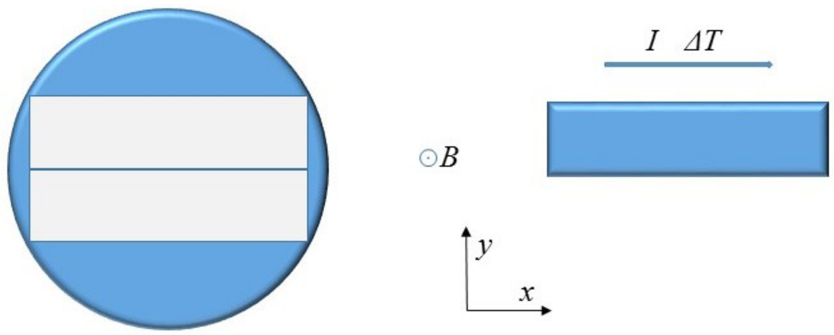

Fig. S3 Schematically showing the as-sintered bulk sample. The thermal gradient (ΔT) and current (I) were applied along longer direction of the sample. The magnetic field ($B = \mu_0 H$) was applied parallel to the width of the sample during the transport measurement.

Definition of parameters

The Seebeck and Nernst effects are longitudinal and transverse thermoelectric responses, respectively. In order to make the description clear in the main text, here we first give a definition of all the transport parameters and their respective directions. The bulk sample of NbP after SPS is cylindrical. We define the height direction as the *z*-axis, while the plate face is the *xy*-plane, as shown in Figure S3. For a polycrystalline sample, there are should be no obvious differences in transport properties in-plane; thus, we consider the sample isotropic. Two bar-shaped samples are cut for transport measurements. We define the length direction as the *x*-axis while the width direction is the *y*-axis. The temperature gradient ΔT is applied along the *x*-axis while the magnetic field *B* is applied along the *z*-axis. The transport parameters are defined as shown in Table S3.

Table S3. Definition of the transport parameters.

Symbol	**Transport parameter**	**Symbol**	**Transport parameter**
α_{xx}	Seebeck thermopower (μV/K)	α_{xy}	Nernst thermopower (μV/K)
ρ_{xx}	Electrical resistivity (Ω cm)	ρ_{xy}	Hall resistivity (Ω cm)
σ_{xx}, σ_{yy}	Electrical conductivity (Ω^{-1} cm^{-1})	σ_{xy}	Hall conductivity (Ω^{-1} cm^{-1})
κ_{xx}	Thermal conductivity (W m^{-1} K^{-1})		
$PF = \alpha_{xx}^2 \cdot \sigma_{xx}$	Power factor (10^{-4} W m^{-1} K^{-2})	$PF_{Nernst} = \alpha_{xy}^2 \cdot \sigma_{yy}$	Nernst power factor (10^{-4} W m^{-1} K^{-2})
zT	Thermoelectric figure of merit	zT_{Nernst}	Nernst figure of merit

The longitudinal and Hall conductivities are related to the resistivities via:

$$\sigma_{xx} = \frac{\rho_{xx}}{\rho_{xx}^2 + \rho_{xy}^2} \text{ and } \sigma_{xy} = -\frac{\rho_{xy}}{\rho_{xx}^2 + \rho_{xy}^2} \quad (1)$$

The thermoelectric figure of merit zT_{S} is calculated according to the expression:

$$zT = \frac{\alpha_{xx}^2 \sigma_{xx}}{\kappa_{xx}} T \quad (2)$$

The Nernst figure of merit zT_{Nernst} is calculated using the formula:

$$zT_{Nernst} = \frac{\alpha_{xy}^2 \sigma_{yy}}{\kappa_{xx}} T \quad (3)$$

For the polycrystalline sample, transport parameters in-plane are considered isotropic, thus $\sigma_{xx} = \sigma_{yy}$.

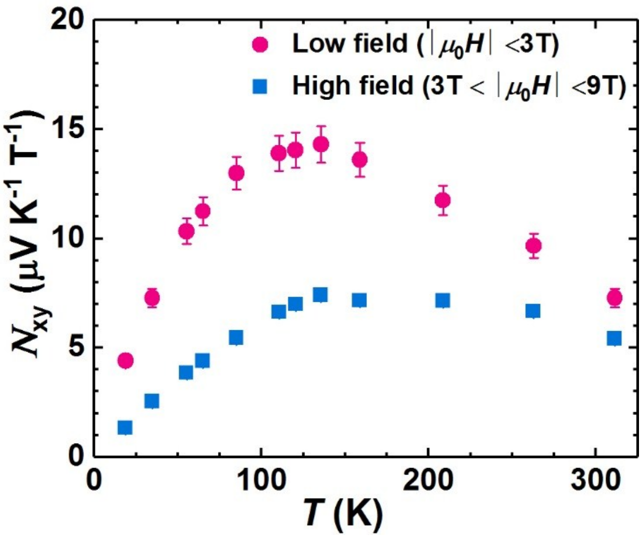

Fig. S4 Nernst coefficient versus temperature at low magnetic field ($\mu_0 H$) and high- $\mu_0 H$ region for polycrystalline NbP.

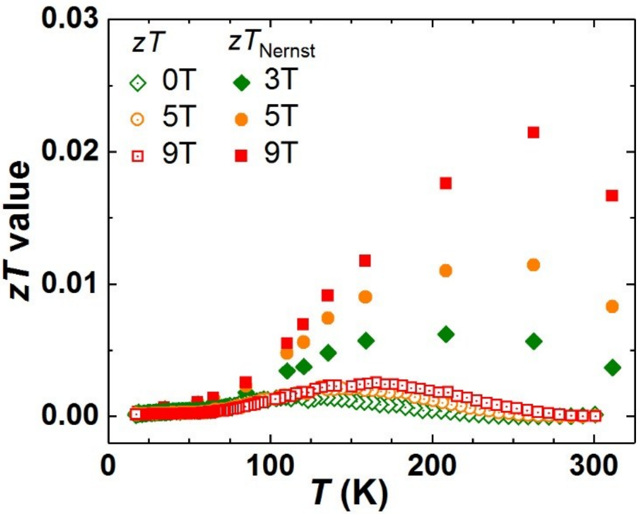

Fig. S5 Temperature dependent zT and zT_{Nernst} for polycrystalline NbP at different magnetic fields.