Supplementary Information (SI) for Physical Chemistry Chemical Physics.

Exploring spin transport and piezoelectricity in flexible 2D V_2STeO altermagnet

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Supporting Information

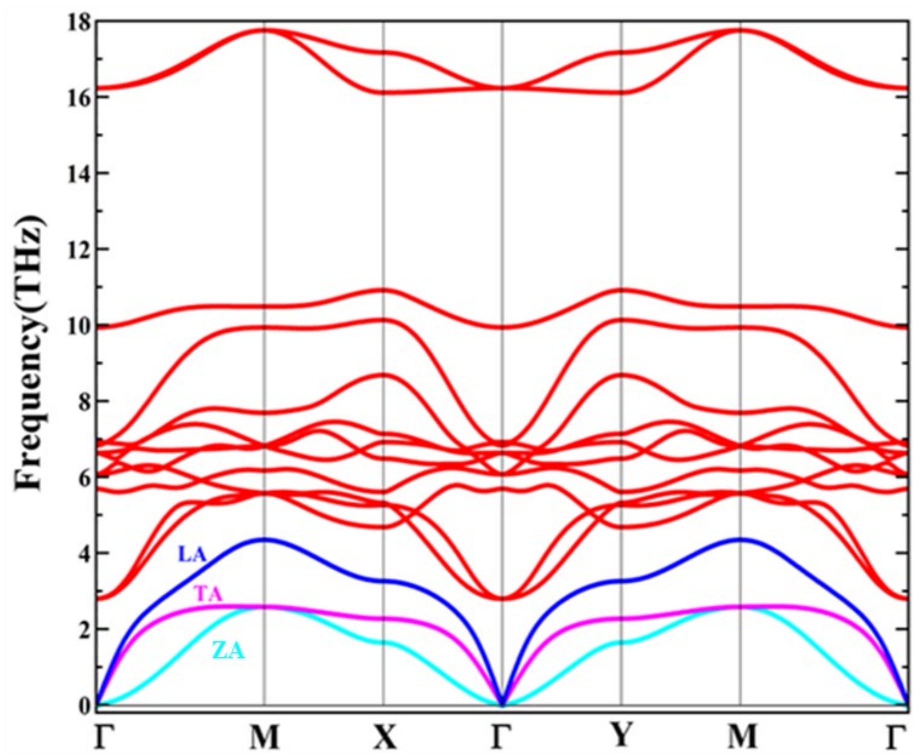

Fig. S1 Phonon dispersion curve of V_2STeO monolayer.

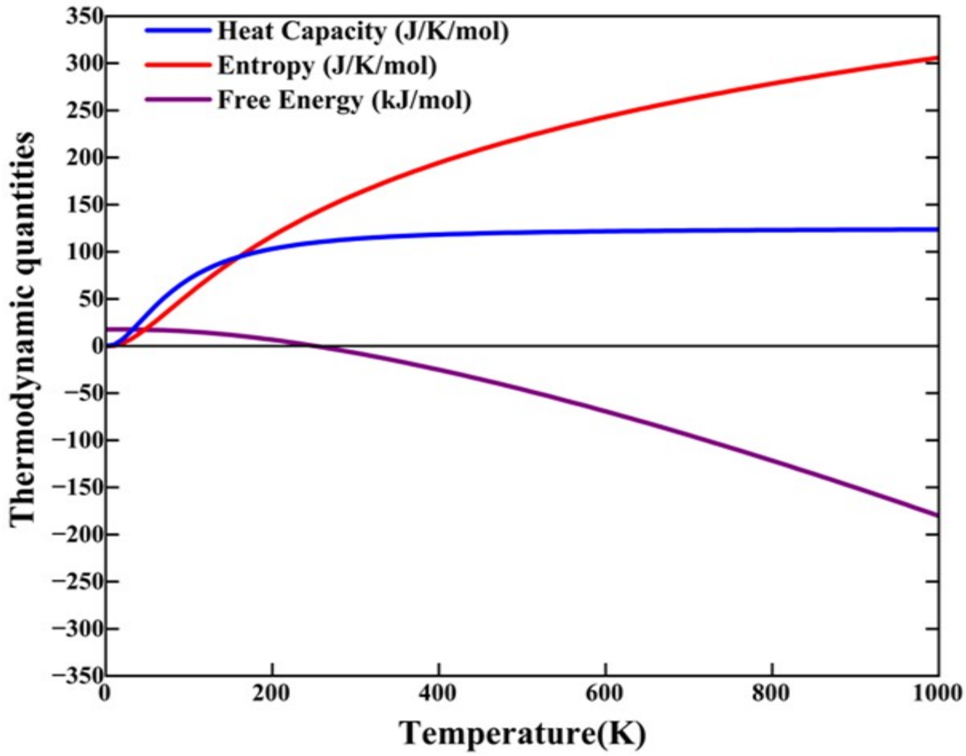

Fig. S2 Heat capacity, Entropy, and Free Energy of V_2STeO monolayer.

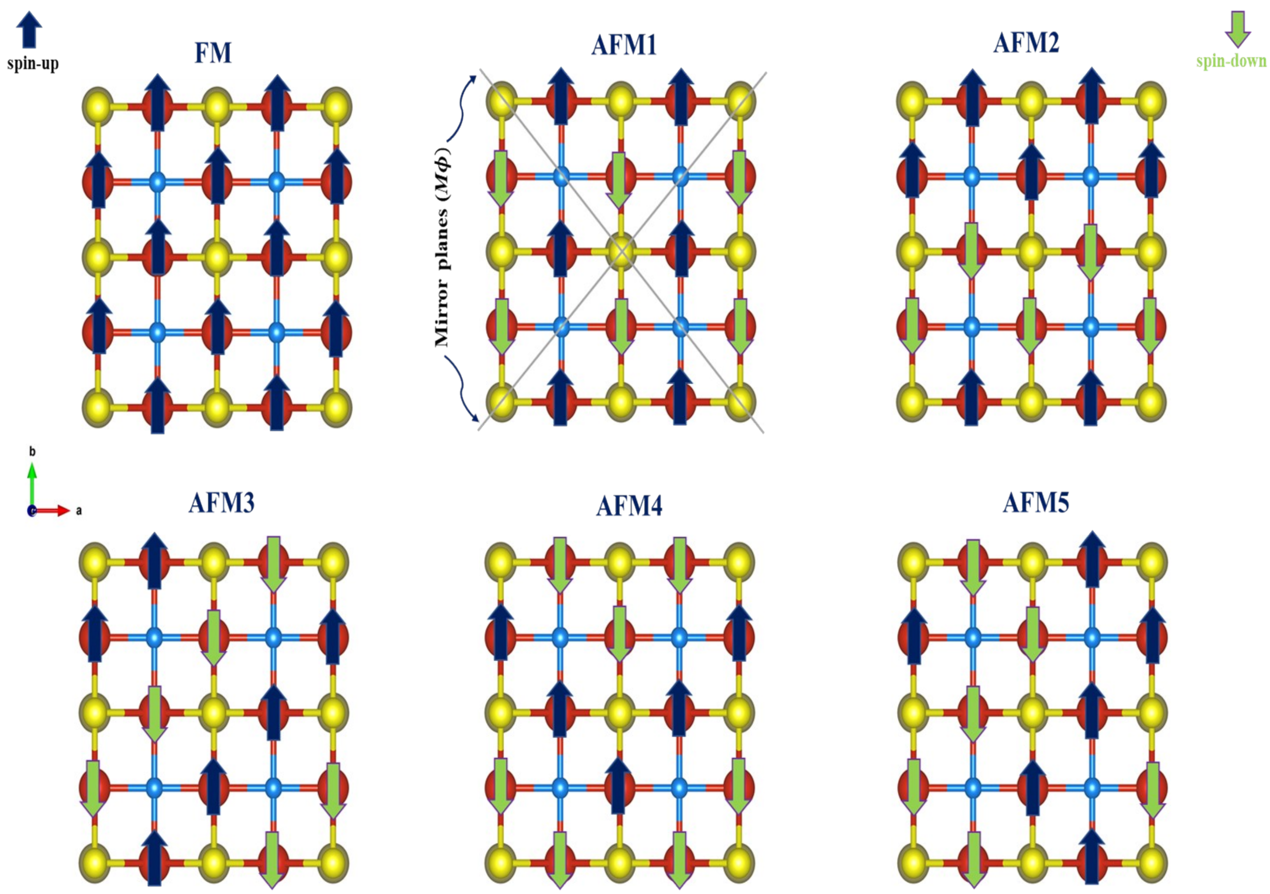

Fig. S3 All possible magnetic configurations of V_2STeO monolayer**.**

Table. 1 Calculated values of mass ratio (m*/m), lattice dielectric constant ($_L$), high-frequency dielectric constant (ε_∞), average sound velocity (v), effective mass (m*/m), mass density (ρ), LO-phonon frequency ($\hbar\omega_{LO}$), and deformation potential constant (D) for electrons and holes for both spin-up in V_2STeO monolayer.

System	Direction	Carrier type	ε_L	ε_∞	v (m/s)	m*/m	D(eV)	ρ (kg/m^3)	$\hbar\omega_{LO\ (eV)}$
	X	electron	6.25	4.24	6572	0.104	1.58	4696	0.073
Spin-Up		hole	6.25	4.24	6572	0.085	3.22	4696	0.073
	Y	electron	6.26	4.24	6572	0.143	1.79	4696	0.073
		hole	6.26	4.24	6572	0.075	3.34	4696	0.073

Table. 2 Calculated values of mass ratio (m*/m), lattice dielectric constant ($_L$), high-frequency dielectric constant (ε_∞), average sound velocity (v), effective mass (m*/m), mass density (ρ), LO-phonon frequency ($\hbar\omega_{LO}$), and deformation potential constant (D) for electrons and holes for spin-down in V_2STeO monolayer.

System	Direction	Carrier type	ε_L	ε_∞	v (m/s)	m*/m	D(eV)	ρ (kg/m^3)	$\hbar\omega_{LO\ (eV)}$
	X	electron	6.25	4.24	6572	0.147	1.76	4696	0.073
Spin-Down		hole	6.25	4.24	6572	0.075	3.35	4696	0.073
	Y	electron	6.26	4.24	6572	0.104	1.67	4696	0.073
		hole	6.26	4.24	6572	0.086	3.21	4696	0.073

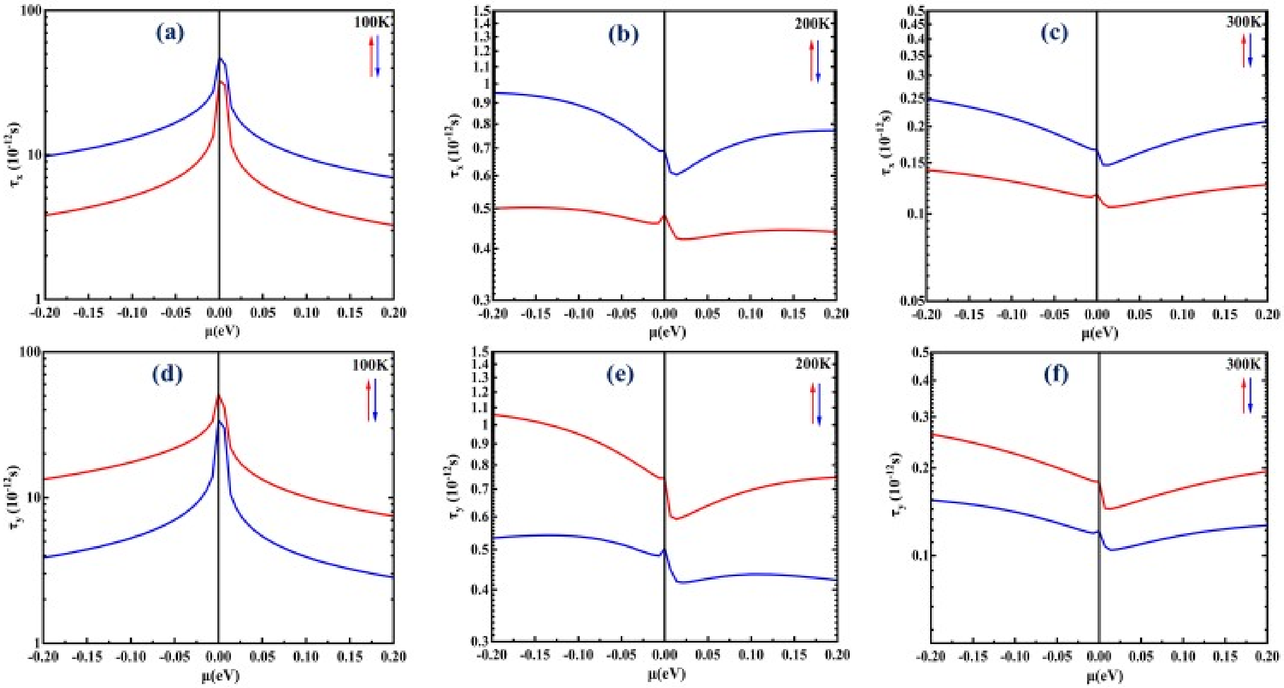

Fig. S4 Spin and energy-dependent total carrier relaxation time (τ): panels (a)–(c) correspond to the X-direction (τ_x), while panels (d)–(f) correspond to the Y-direction (τ_y) of 2D V_2STeO monolayer.

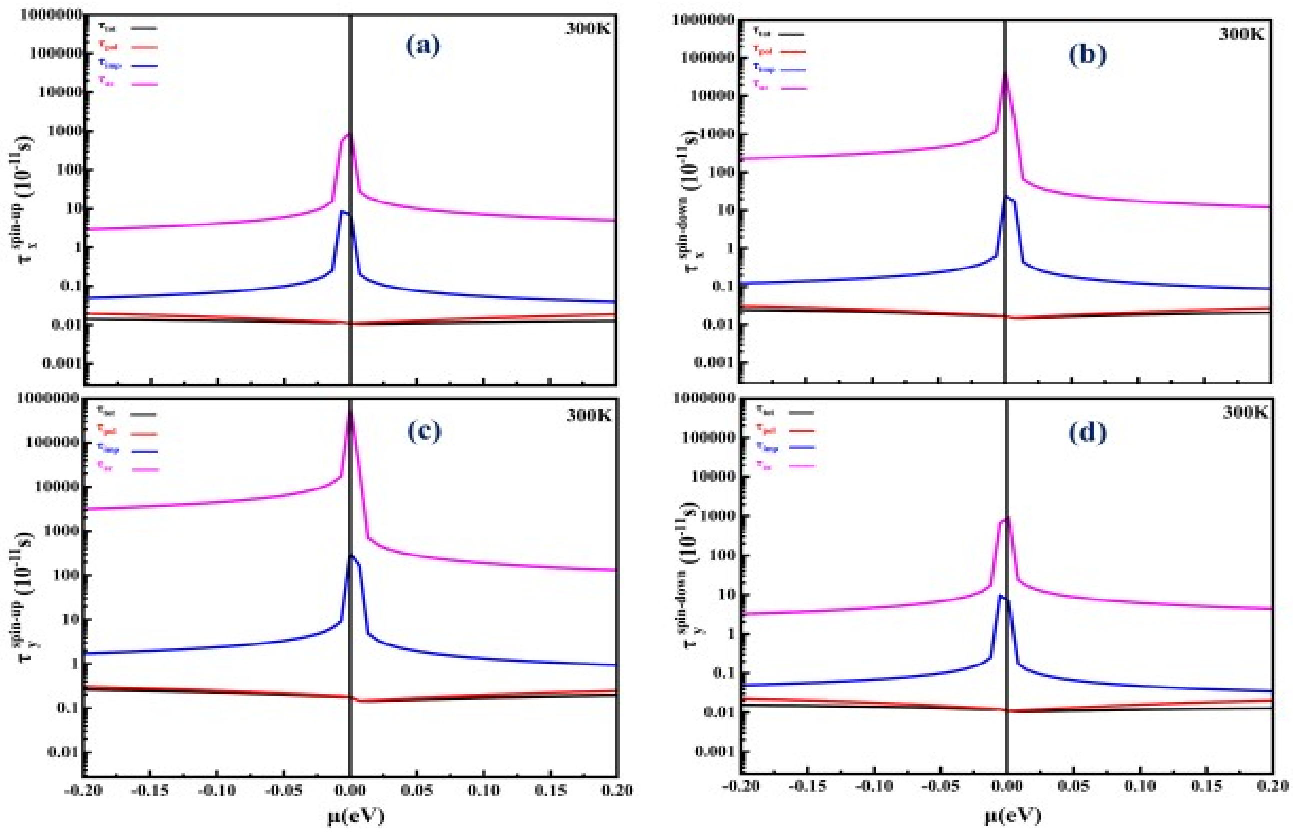

Fig. S5 Energy dependent total **[black-color]** relaxation time (τ_{tot}) at 300 K, together with the individual contributions from impurity **[blue-color]** (τ_{imp}), acoustic **[purple-color]** phonon(τ_{ac}), and polar optical phonon **[red-color]** scattering (τ_{pol}): (a) spin-up carriers along the X direction ($\tau_x^{spin-up}$), (b) spin down carriers along the X direction($\tau_x^{spin-down}$), (c) spin up carriers along the Y direction ($\tau_y^{spin-up}$), and (d) spin down carriers along the Y direction ($\tau_y^{spin-down}$) of 2D V_2STeO monolayer.

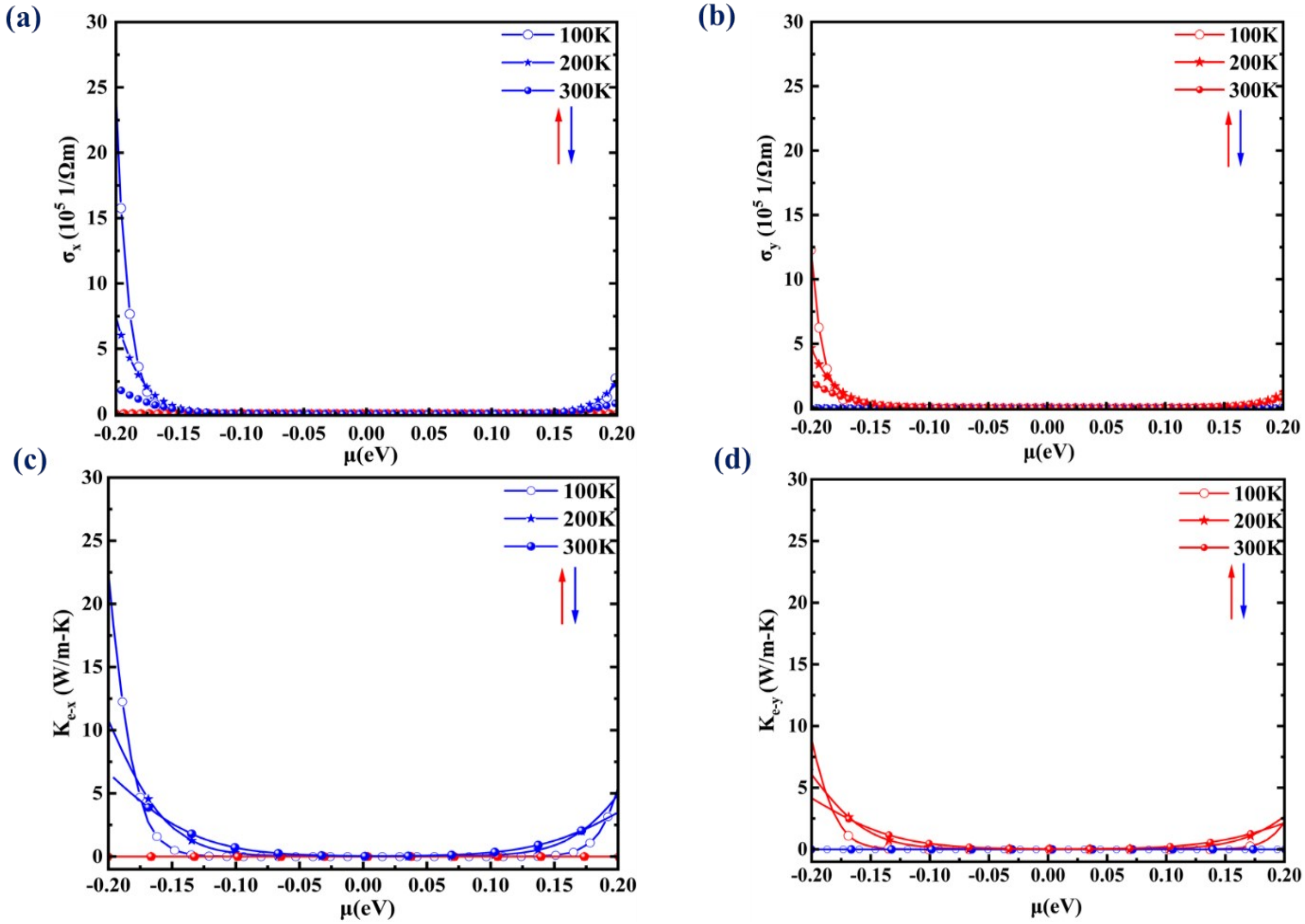

Fig. S6 Spin dependent electrical conductivity with varying temperatures (a) along X direction (σ_x) and (b) along Y direction (σ_y). Spin dependent electronic thermal conductivity with varying temperatures (c) along X direction (K_{e-x}) (d) along Y direction (K_{e-y}) of 2D V_2STeO monolayer.

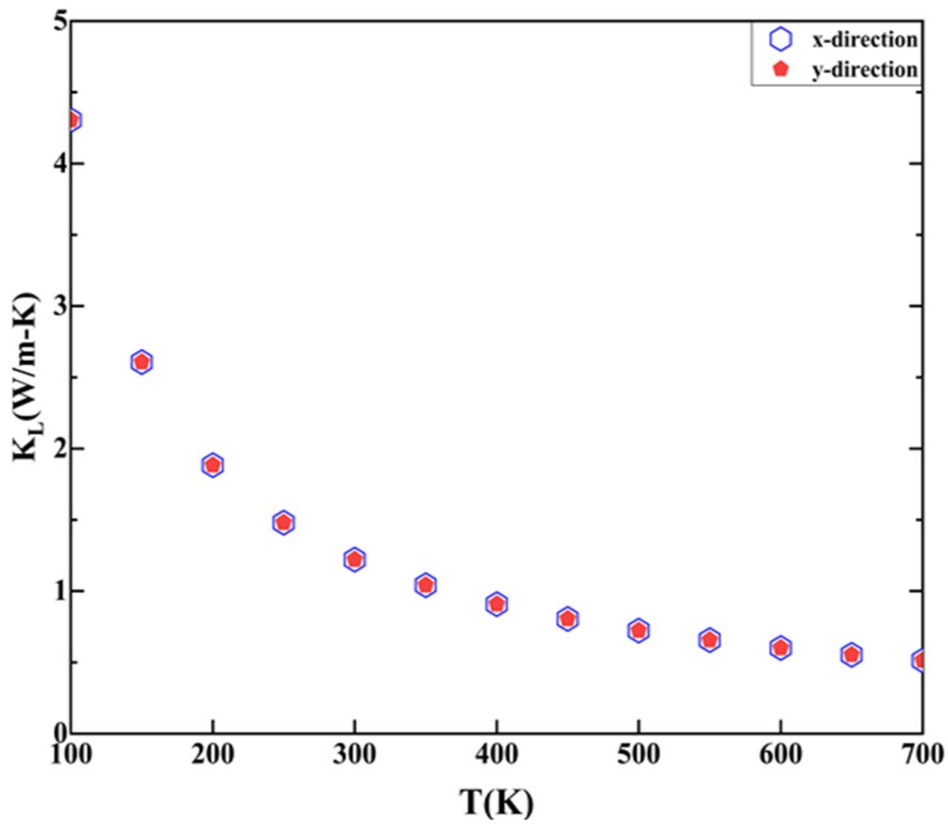

Fig. S7 Lattice thermal conductivity of V_2STeO monolayer.