Crystal structure, Magnetotransport properties, and Electronic band structure of $V_{1-x}Ti_xSe_2$ single crystals

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Figure S1 shows the VSe_2 and $TiSe_2$ single crystals synthesized by using the conventional solid-state method. The SEM-EDS mapping of $V_{0.5}Ti_{0.5}Se_2$ presented in Figure S1b indicates that the Ti, V, and Se elements were evenly distributed over the surface.

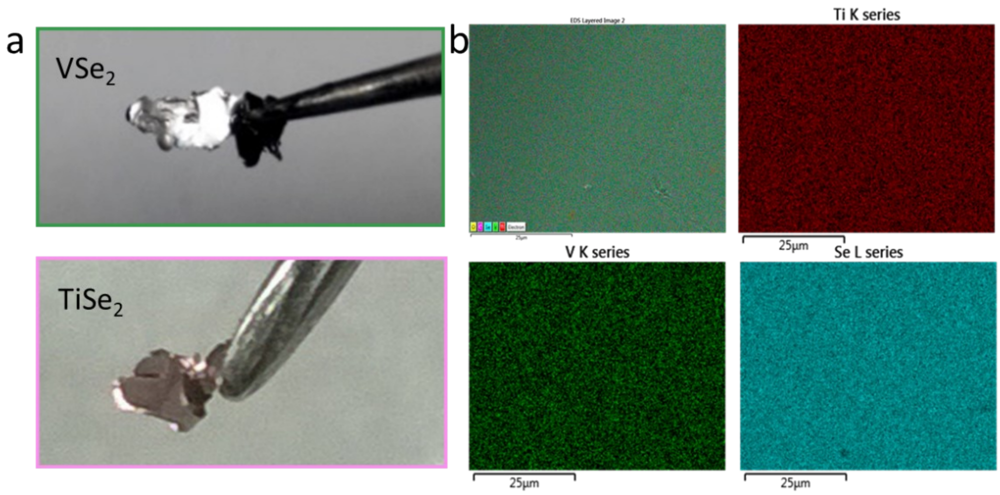

Figure S1 $V_{1-x}Ti_xSe_2$ single crystal: a. VSe_2 and $TiSe_2$ single crystals. b. Scanning electron microscope (SEM) image and energy dispersive spectroscopy (EDS) mapping of Ti, V, and Se for $V_{0.5}Ti_{0.5}Se_2$.

The universal effect that deficiency in the chalcogen site could change the shape of the Fermi surface and the transport properties. Since the deficiency in the chalcogen site dopes electron to the system and leads lower resistivity, and the electron doping effect can also shift the Fermi surface.[1,2] The content of V, Ti and Se in $V_{1-x}Ti_xSe_2$ samples was acquired on a Thermo Fisher Scientific iCAP RQ inductive (America) coupled plasma mass spectrometer (ICP-MS), as shown in the table below. The ICP-MS results of $V_{0.5}Ti_{0.5}Se_2$ analysis reveals that the ratios of V: Ti: Se were 1: 1: 4 and 1: 1: 4 denoted as S1 and S2. The Se contents were calculated to be 7.55 and 7.58 mg g^{-1} in S1 and S2, respectively. The results indicate a slight deficiency of Se (0.3%) in the samples, but the molar ratios are generally consistent with the molecular formula.

Tabl S1. Elemental compositions of the samples.

ICP-MS results of $V_{0.5}Ti_{0.5}Se_2$

Sample	Element	Exp	Cal	Mass Ratio(wt%)
S1	V	0.5	0.500	0.122
	Ti	0.5	0.528	0.121
	Se	2.0	1.988	0.755
S2	V	0.5	0.500	0.122
	Ti	0.5	0.528	0.121
	Se	2.0	1.994	0.758

References

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2. J. S. Chen, J. K. Wang, S. V. Carr, S. C. Vogel, O. Gourdon, P. Dai, E. Morosan, *Phys. Rev. B*, **2015**, 91, 045125.