Supplemental Material for

"The Dirac Cone in Two-Dimensional Tetragonal Silicon Carbide: Ring Coupling Mechanism"

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	a (Å)	b (Å)	c (Å)	θ (°)	Bond length (Å) C-C	Si-Si	C-Si	Ec (eV)
graphene	2.468	2.468	PL	120	1.425			9.141
	2.461[a]	2.461[a]	PL	120[a]	1.421[a]			9.259[a]
T graphene (planar)	3.447	3.447	PL	90	b_1 :1.374		b_2 :1.466	8.626
	3.41[b]	3.41[b]	PL	90[b]				
silicene	3.867	3.867	0.453	120		2.278		4.698
	3.865[a]	3.865[a]		120[a]		2.276[a]		4.784[a]
h-SiC	3.097	3.097	PL	120			1.787	6.941
	3.084[a]	3.084[a]	PL	120[a]			1.780[a]	7.076[a]
T1 SiC	6.094	6.094	PL	90	b_1 :1.813		b_2 :1.747	6.676
T2 SiC	6.246	6.246	PL	90	1.465	2.264	1.781	6.378
T3 SiC	4.032	4.758	0.536	90	1.374	2.292	1.854	6.459

a Reference 1.

b Reference 2.

Table.S1 The lattice information and cohesive energy(E_c) of T-SiC are calculated. In order to evaluate the structural characteristics and stability of T-SiC, the corresponding parameters of graphene, T graphene, silicene, and h-SiC are calculated, and the corresponding values in the literature are also given. It can be seen that the two are quite consistent.

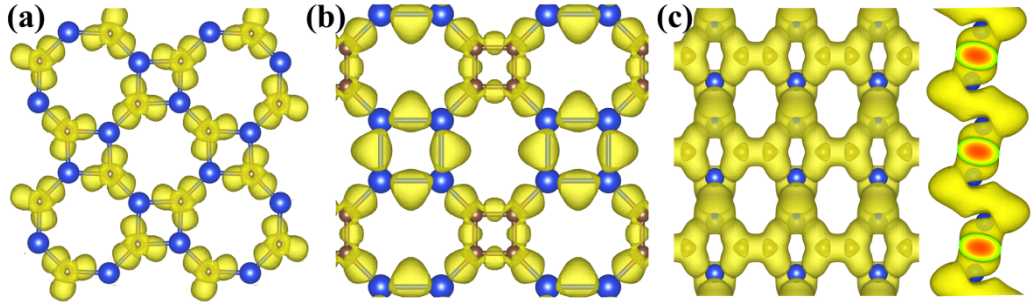

Fig.S1 Electron localization function(ELF) of (a)T_1-SiC (b)T_2-SiC and (c)T_3-SiC.

Charge distribution (Bader analysis)				
	h-SiC	T1-SiC	T2-SiC	T3-SiC
C	6.51	6.48	4.62-5.03	5.23-5.47
Si	1.49	1.51	3.03-3.31	2.62-2.68

Table.S2 The number of electrons around an atom calculated using Bader charge analysis.

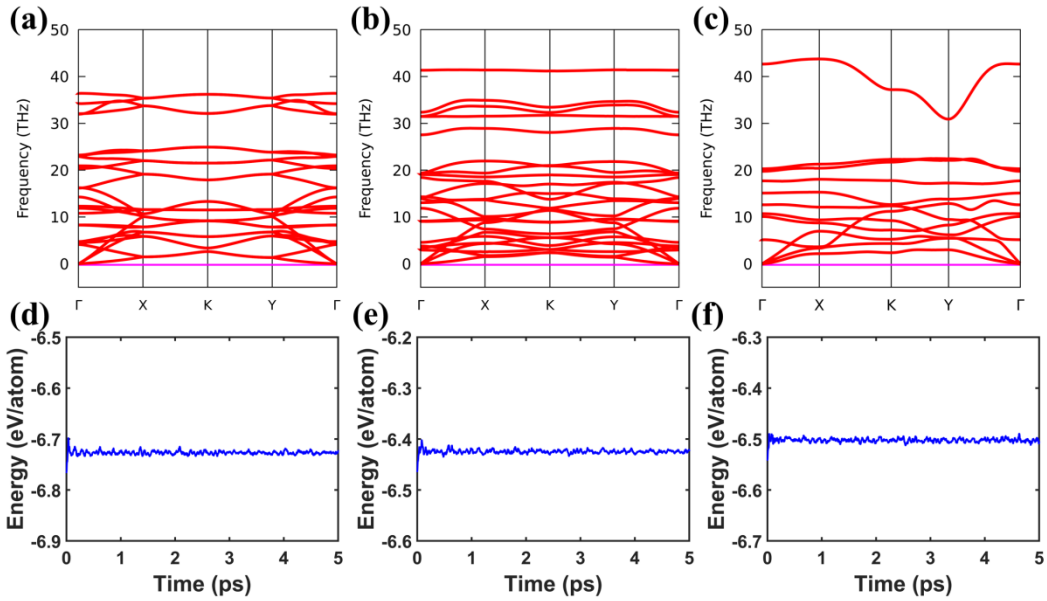

Fig.S2 Phonon spectra of (a)T_1-SiC (b)T_2-SiC and (c)T_3-SiC, all branches have positive frequencies. And finite temperature(300k) molecular dynamics (MD) simulations of (d)T_1-SiC (e)T_2-SiC and (f)T_3-SiC, The energy oscillates only slightly over time.

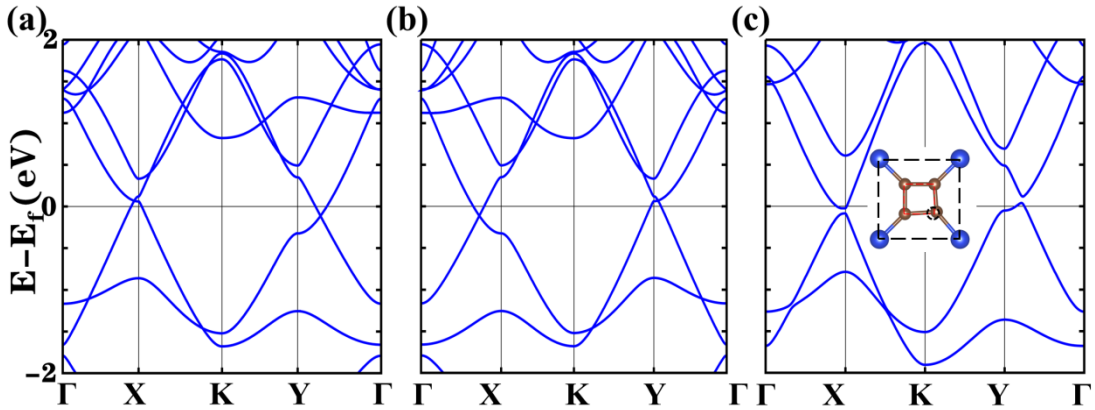

Fig.S3 Band structure of T_2-SiC with 8% strain applied along the (a)X-axis and (b)Y-axis, respectively. (c)The Dirac cone is opened when the structural symmetry is broken.

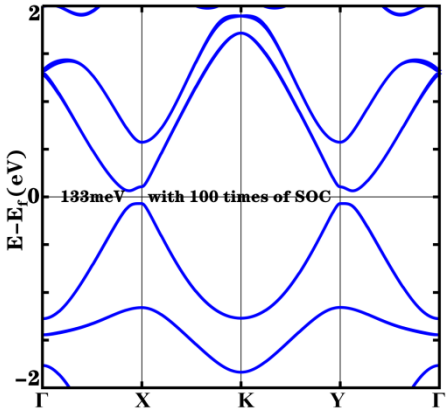

Fig.S4 Band structures with 100 times SOC of T_2-SiC.

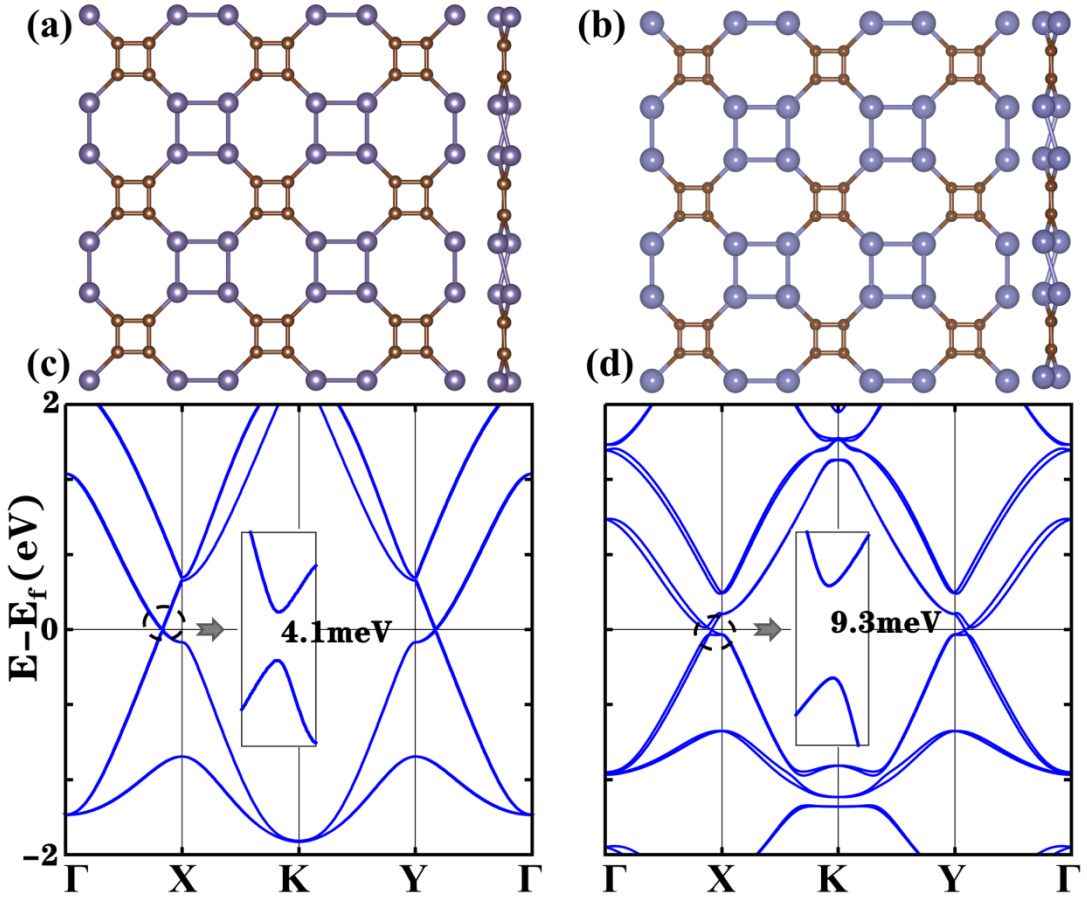

Fig.S5 The structure of (a)T_2-GeC (b)T_2-SnC. Band structures with SOC of (c)T_2-GeC (d)T_2-SnC.

References

1. X. Qin, Y. Liu, X. Li, J. Xu, B. Chi, D. Zhai and X. Zhao, *J. Phys. Chem. Lett.*, 2015, **6**, 1333-1339.
2. Y. Liu, G. Wang, Q. Huang, L. Guo and X. Chen, *Phys. Rev. Lett.*, 2012, **108**, 225505.