Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

MXene $Ti_3C_2T_x$ for Phase Change Composite with Superior Photothermal Storage Capability

Xiaoqiao Fan[a], Lu Liu[a], Xin Jin[b], Wentao Wang[c], Shufen Zhang[a], and Bingtao Tang[a,b]*

[a] State Key Laboratory of Fine Chemicals, Dalian University of Technology, Dalian 116024, PR China

[b] Eco-chemical Engineering Cooperative Innovation Center of Shandong, Qingdao University of Science and Technology, Qingdao 266042, PR China

[c] Key Laboratory of Advanced Textile Materials and Manufacturing Technology, Ministry of Education, Zhejiang Sci-Tech University, Hangzhou 310018, PR China

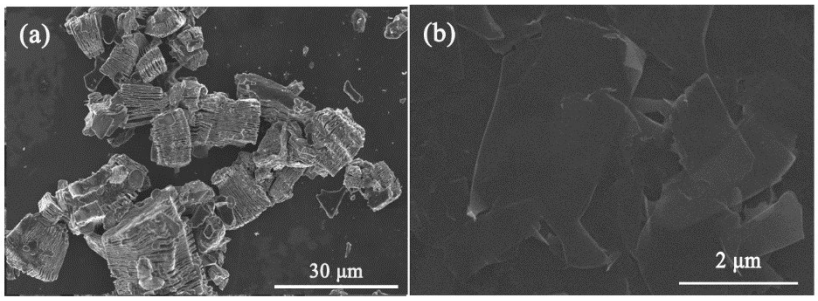

Figure S1. SEM images of Ti_3AlC_2 after etching of HF solution (a) and $Ti_3C_2T_x$ nanosheets (b).

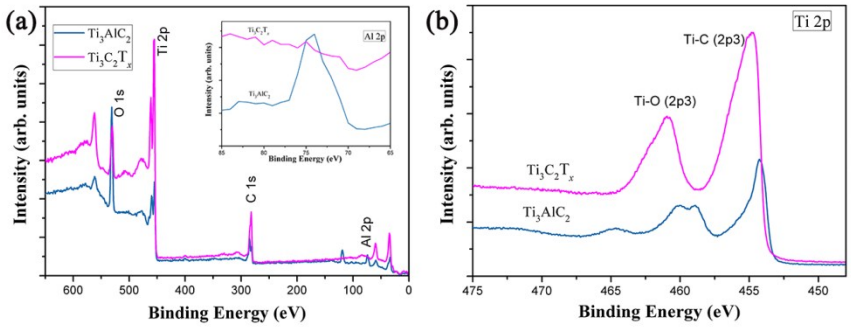

Figure S2. XPS spectra of Ti_3AlC_2 and $Ti_3C_2T_x$ samples.

Figure S3. The photo of the PEG(85%)/$Ti_3C_2T_x$composite.

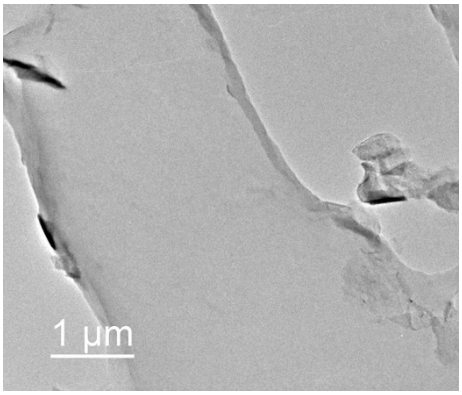

Figure S4. The cross-sectional TEM image of the composite.

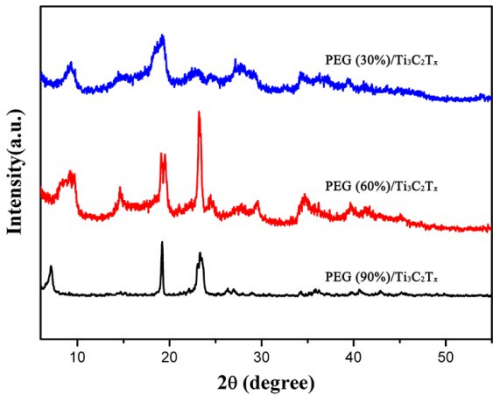

Figure S5. The XRD curves of PEG/$Ti_3C_2T_x$ with different PEG contents.

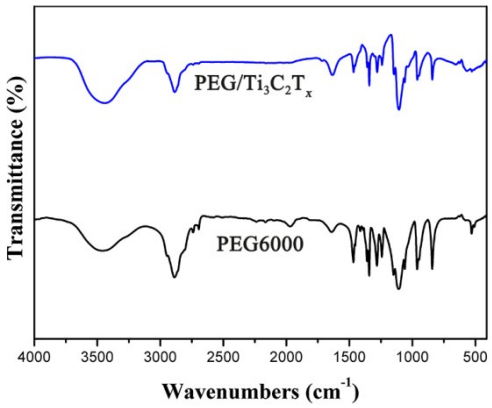

Figure S6. The IR spectra of pure PEG and PEG(90%)/$Ti_3C_2T_x$.

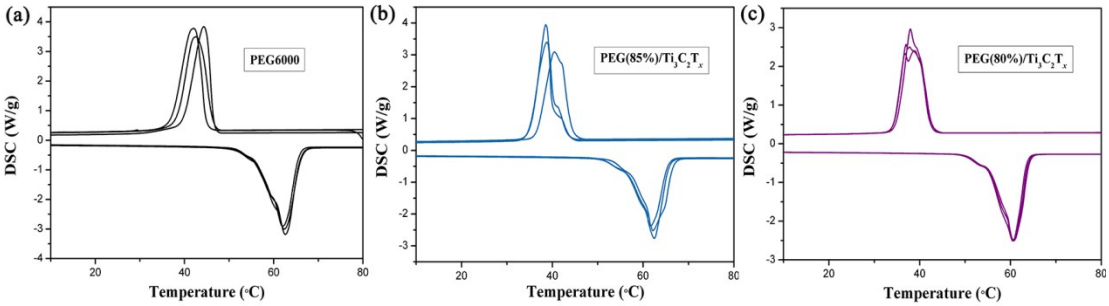

Figure S7. The three groups DSC curves for pure PEG, PEG(85%)/$Ti_3C_2T_x$ and PEG(80%)/$Ti_3C_2T_x$.

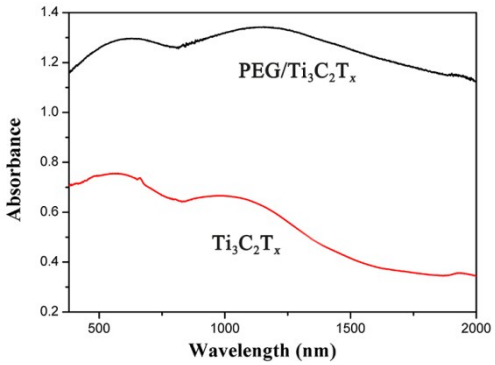

Figure S8. The absorbance spectra of PEG(80%)/$Ti_3C_2T_x$ (1.25 mm) and $Ti_3C_2T_x$ nanosheets (thickness: 0.10 mm).

Table S1 The comparison of this work with results of other form–stable PCMs with photothermal conversion and thermal energy storage in literature.

Form-stable PCM	Light intensity (mW/cm^2)	Light to thermal conversion and storage efficiency (η)	Reference
Paraffin wax/carbon nanotube sponge	90	54%	[11]
Paraffin/anisotropic graphene aerogels	100	77%	[12]
Polyurethane-based PCM/halloysite nanotubes-hybrid graphene aerogel	100	78.4%	[13]
Polyurethane/graphite foam	90	67%	[10]
PEG/polydopamine@BN	100	73.1%	[17]
Wax/graphene foam	150	79.9%	[14]
Polyurethane/rGO	100	78.7%	[15]
PEG/BN/GNP	100	72.7%	[18]
PEG/hybrid graphene aerogels (GO, GNs)	100	91.9%	[19]
PEG/$Ti_3C_2T_x$	128.6/66.5-71.3	94.5%	This work

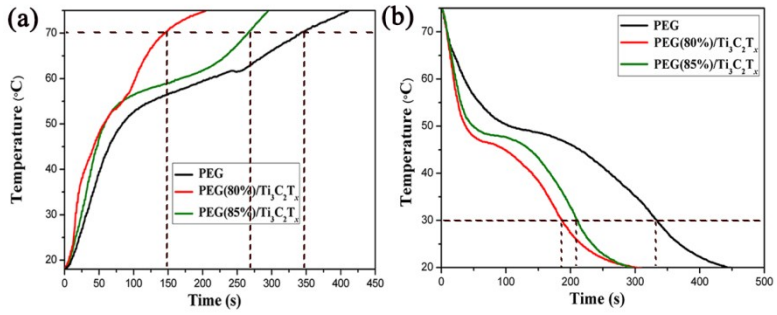

Figure S9. The effect of the enhanced thermal conductivity on the heat storage and release rates of PCMs (m=1 g).

Table S2 The thermal conductivities of the composites with different contents of $Ti_3C_2T_x$ nanosheets.

Samples	PEG	PEG(85%)/$Ti_3C_2T_x$	PEG(80%)/$Ti_3C_2T_x$
Thermal conductivity (W/(m·K))	0.211	0.293	0.321
Increment rate (%)	-	38.9%	52.1%

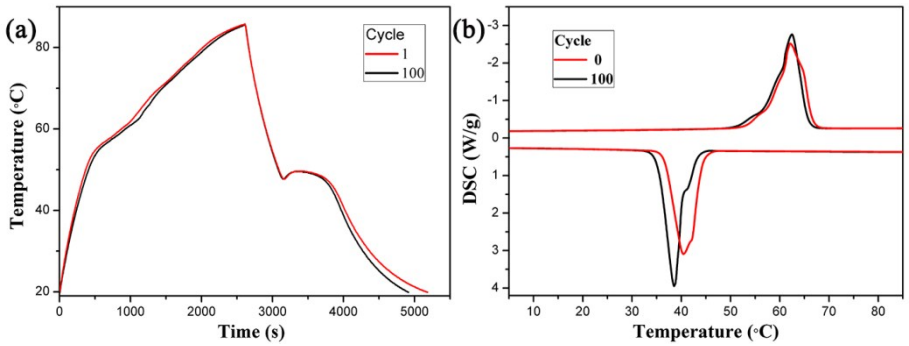

Figure S10. The temperature evolution curves (a) and DSC curves (b) of PEG(85%)/$Ti_3C_2T_x$ (m=2 g) before and after 100 cycles under simulated light illumination.