SUPPORTING INFORMATION

Enhanced Thermal Properties for Poly(vinylidene fluoride) Composites with Ultrathin Nanosheets of MXene

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SUPPLEMENT

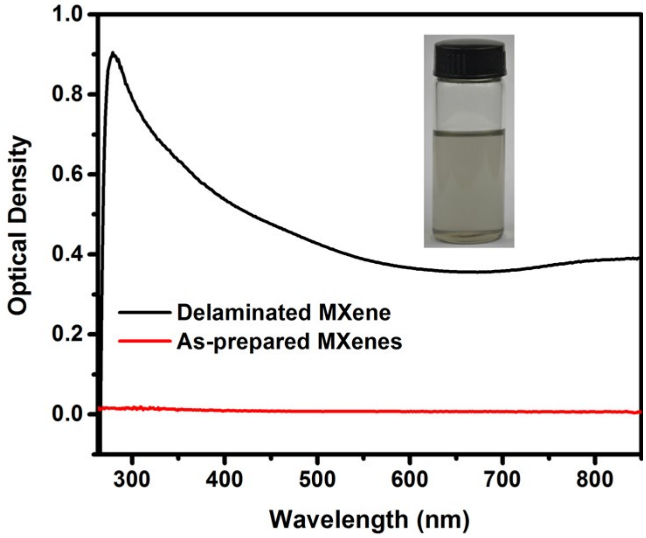

Figure S1. UV-Visible spectra of as-prepared MXenes and delaminated MXene nanosheets in DMF.

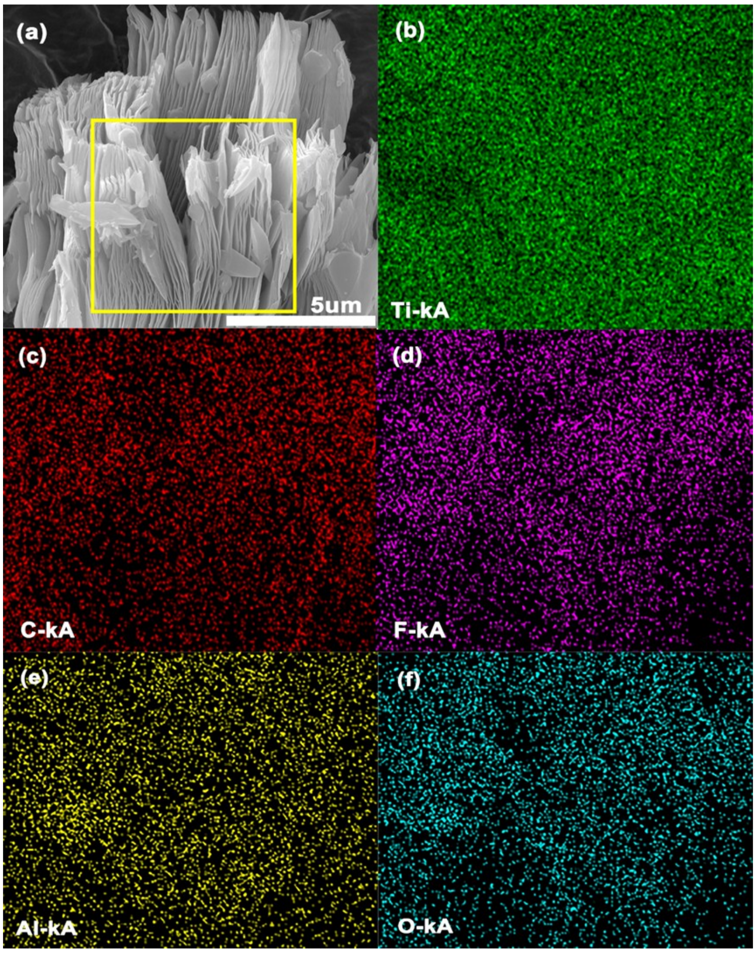

Figure S2.FE-SEM images of (a) MXenes and EDS images of MXene: (b) Ti, (c) C, (d) F, (e) Al, (f) O.

UV/VIS/NIR spectrophotometer was used to characterize the as-prepared MXenes and delaminated MXene nanosheets in DMF and UV/visible absorption spectra are shown in **Figure S1**. It is obvious that as-prepared MXenes does not possess an evident absorption in the UV/visible region while delaminated MXene nanosheets show quite high absorption at 280 nm in the UV region.

Figure S2 shows FE-SEM image and EDS images of MXenes. From **Figure S2 (a)**, it can be seen that the MXenes are made up of many layered nanosheets resembling exfoliated graphite and the thickness is quite small. In order to have a preliminary understanding of the surface element of MXenes, X-ray energy-dispersive spectroscopy (EDAX) was performed and the EDX images are shown in **Figure S2 (b-f)**, which demonstrated that MXenes are composed of Ti, C, F, Al, O. The existence of F and O implied that Al layers were replaced by F or O to a certain extent.

Neat PVDF and PVDF/MXene composites are characterized by XRD and the results are shown as **Figure S3**. It is clearly observed that PVDF/MXene composited have peaks around 17.6, 18.4, 20.0 °C, which indicates that PVDF possess α-crystallite other than β-crystallite according to the literature[1].

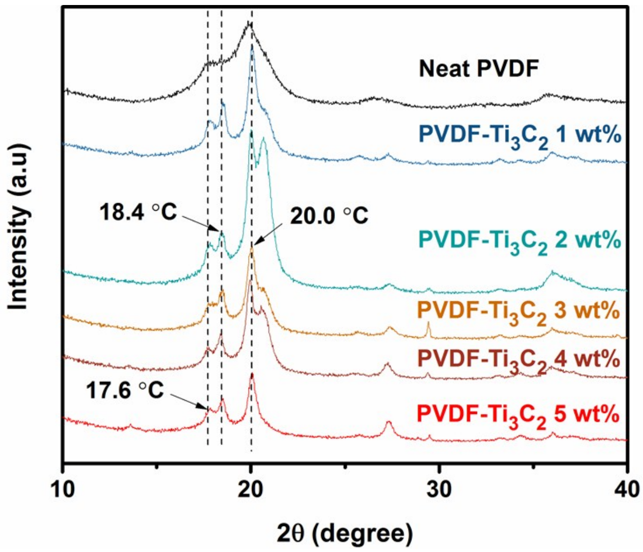

Figure S3 XRD of the neat PVDF and PVDF composites.

The heating DSC thermograms of neat PVDF and PVDF/MXene composites with different loading of MXene ($Ti_3C_2T_x$) were gained by Pyris Diamond DSC (Perkin-Elmer, American) and shown in **Figure S4**. **Figure S4** exhibits that the melting temperatures of neat PVDF and PVDF/MXene with the content ranging from 1 wt% to 5 wt% are 162.23 °C, 162.18 °C, 162.70 °C and 162.52 °C, 163.05 °C and 162.61°C, respectively. Obviously, the incorporation of MXene does not significantly decrease the melting temperature of PVDF.

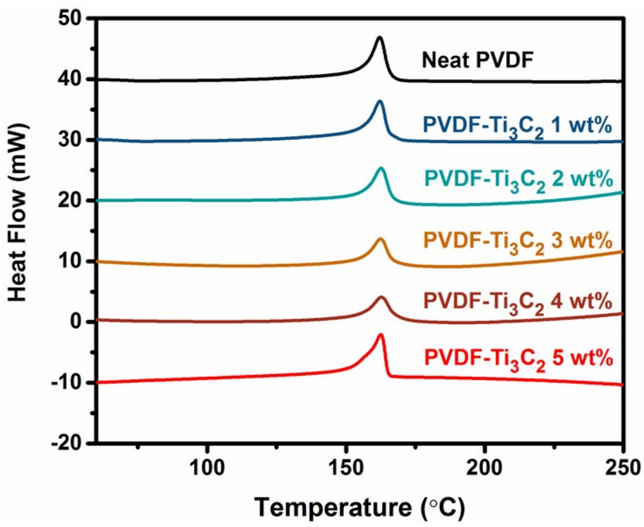

Figure S4 DSC thermograms of neat PVDF and PVDF composites.

TGA and DTG curves of neat PVDF and PVDF composites are shown in **Figure S5. Figure S5 (a)** shows that TGA curves of neat PVDF and PVDF composites all exhibit two obvious weight-loss steps, which implies that degradation mechanism of PVDF does not significantly change in the case of MXene. Besides, it is interesting to figure that the weight-loss temperature of PVDF composites tend to lower temperature compared with that of neat PVDF. Especially for PVDF composites with 5 wt% of MXene, the weight-loss temperature decreases as high as 123 °C ,which can be clearly observed from **Figure S5 (b)**. Accordingly, we may safely draw the conclusion that the addition of MXene contributes to the decomposition of PVDF and results in a big shifting from high temperature to low temperature. As far as we are aware, there are no relevant report about the mechanism of promoting the decomposition of neat PVDF. We assume that promotion may be ascribed to the fact that MXene result in the formation of new compound accelerating the decomposition of PVDF at low temperature. Further studies are in progress to reveal the mechanism explaining the novel behavior of MXene nanaosheets on the decomposition temperature of PVDF.

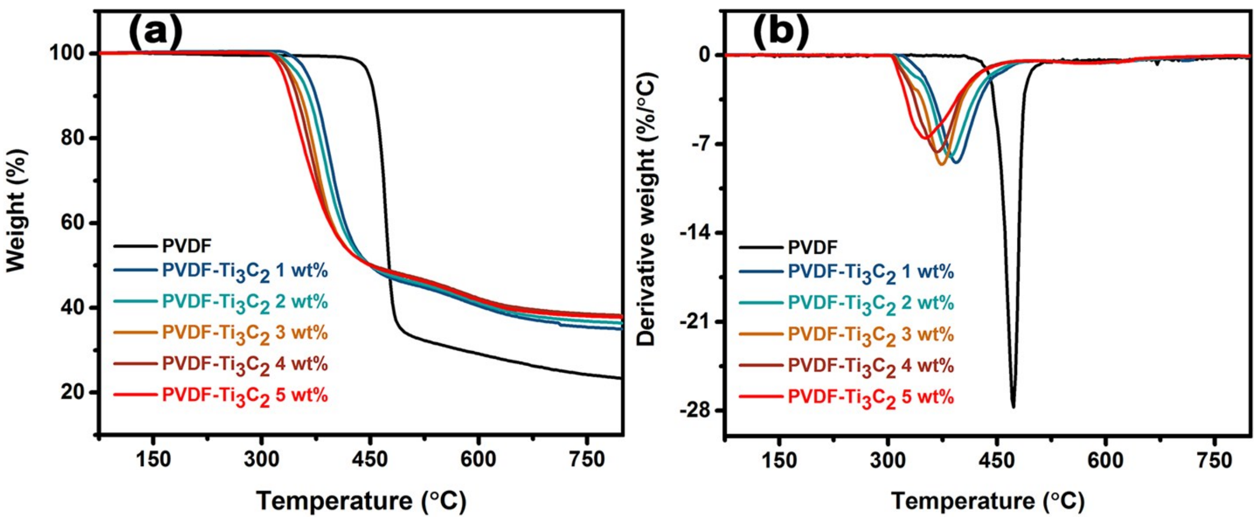

Figure S5 (a) TGA and (b) DTG curve of the neat PVDF and PVDF composites.

Reference:

1. P. Martins, A. C. Lopes and S. Lanceros-Mendez, *Progress in Polymer Science*, 2014, 39, 683-706.