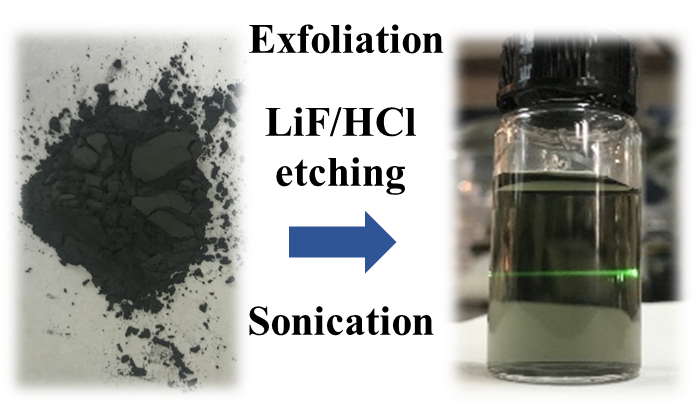
***Supplementary Material***

**Breathable and Wearable MXene-Decorated Air-Laid Paper with Outstanding Folding Endurance and Electromagnetic Interference Shielding Performances**

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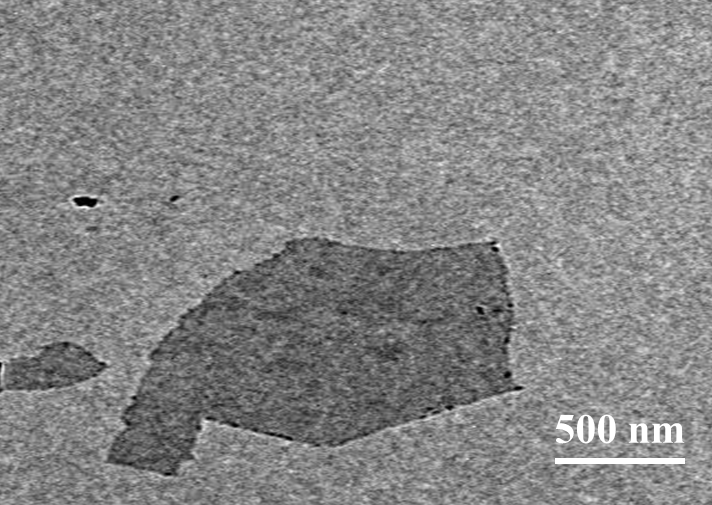
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**Figure S1.** Digital image of MAX phase and the Tyndall effect of MXene nanosheets aqueous suspension after etching.

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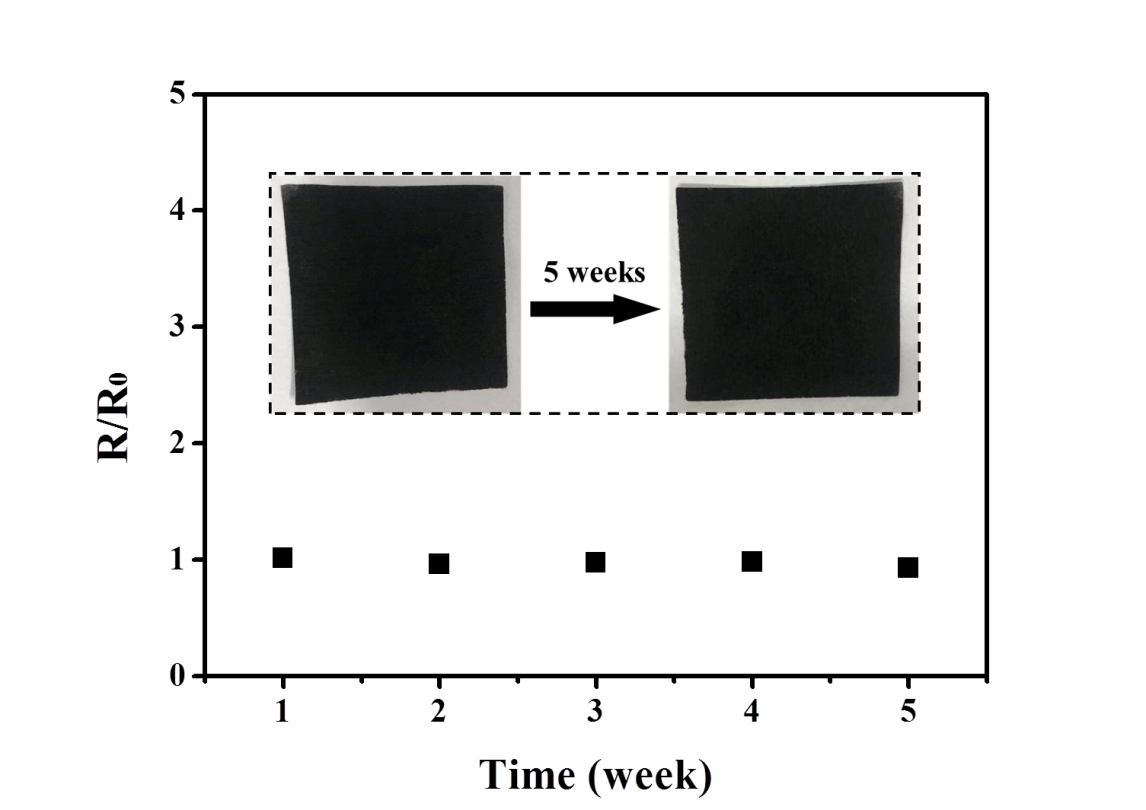
**Figure S2.** The SEM image of MAX phase.

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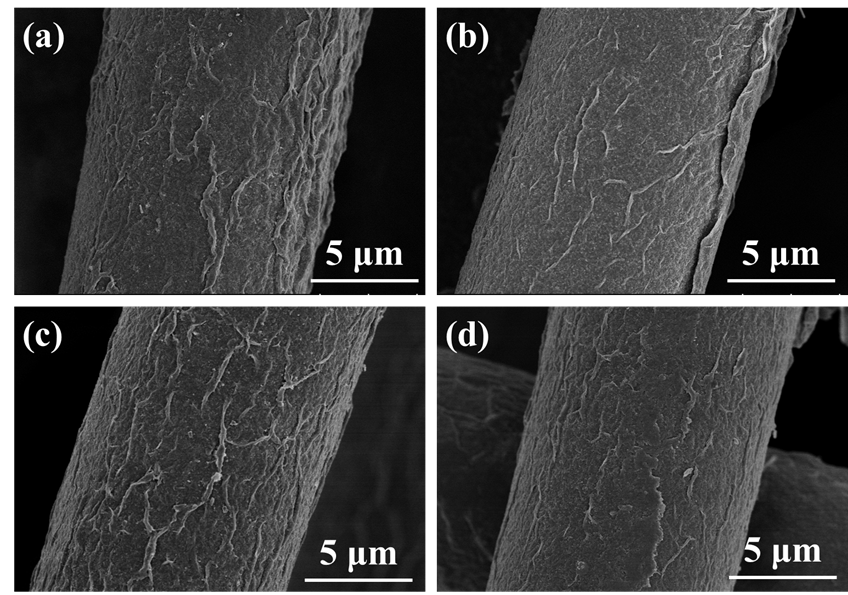
**Figure S3.** The TEM image of MXene nanosheets.



**Figure S4.** XRD patterns of MAX (Ti3AlC2) phase and MXene nanosheets.

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**Figure S5.** Oxidation stability of MP-20 after a period of time.

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**Figure S6.** SEM images of (a) the original MP-20; (b) MP-20 after folding; (c) MP-20 after treating by artifical sweat; (d) MP-20 after 5 weeks.

**Table S1.** Comparison of the EMI shielding performance of the MXene/air-laid paper composite and the other materials.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sample** | **Type** | **Materials** | **Thickness(mm)** | **SSE/t(dB cm2g-1)** | **Reference** |
| 1 | Metal based  Carbon | copper | 3.1 | 32.3 | (Shui et al, 1997) |
| 2 | Ni fiber/PES | 2.85 | 108.7 | (Shui et al, 1997) |
| 3 | SS | 4 | 27.5 | (Li et al, 1994) |
| 4 | CuNi/CNT | 1.5 | 1580 | (Ji et al., 2014) |
| 5 | Ag NW/PI | 0.5 | 2416 | (Ma et al., 2015) |
| 6 | SS/PP | 3.1 | 241.9 | (Ameli et al., 2014) |
| 7 | Graphene/PS | 2.5 | 692 | (Yan et al., 2015) |
| 8 | based  MXene based | Graphene/PEDOT | 0.8 | 841 | (Dalal et al., 2016) |
| 9 | Graphene/Fe3O4 | 0.3 | 1033 | (Song et al., 2015) |
| 10 | MWCNT/PC | 2.1 | 163 | (Pande et al., 2014) |
| 11 | SWCNT/PS | 1.2 | 275 | (Yang et al., 2005) |
| 12 | CB/ABS | 1.1 | 190 | (Al-Saleh et al., 2013) |
| 13 | CB/EPDM | 2 | 15.1 | (Chakrabarti, 2000) |
| 14 | Carbon foam | 2 | 1250 | (Moglie et al., 2012) |
| 15 | Ti3C2Tx/CNFs | 0.047 | 2647 | (Cao et al., 2018) |
| 16 | MXene/air-laid paper | 0.119 | 1931.5 | This work |
|  |  |  | 0.117 | 2001.4 |  |
|  |  |  | 0.116 | 1941.9 |  |

Note:

PES- polyethersulfone

CNT- carbon nanotube

SS- stainless steel

NW- nanowire

PI- polyimide

PP- polypropylene

PS- polystyrene

PEDOT- poly(3,4-ethylenedioxythiophene)

MWCNT- multi-wall carbon nanotube

SWCNT- single-wall carbon nanotube

PC- polycarbonate

CB- carbon black

ABS- acrylonitrile butadiene styrene copolymers

EPDM- ethylene propylene diene monomer

CNFs- cellulose nanofibers

**Table S2.** The mechanical properties of the MXene/air-laid paper composite sheets in different dip-coating cycle numbers.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample** | **Tensile strength (Mpa)** | **Tensile strain (%)** | **Young’s modulus (MPa)** | **Folding endurance** |
| Original  Air-laid paper | 17.34±3.55 | 64.72±6.49 | 103.70±30.49 | 99750 |
| MP-3 | 20.36±2.34 | 53.08±3.87 | 144.69±47.41 | 96539 |
| MP-5 | 23.26±2.07 | 56.61±4.84 | 183.57±58.84 | 98301 |
| MP-10 | 16.97±3.81 | 54.54±2.61 | 152.51±75.45 | 99572 |
| MP-20 | 16.73±1.45 | 55.69±4.64 | 94.70±28.73 | 97564 |

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