Electronic Supplementary Information (ESI)

Online Fabrication of Ultralight, Three-Dimensional Ultrafine Fibre Assemblies with a Double-porous Feature

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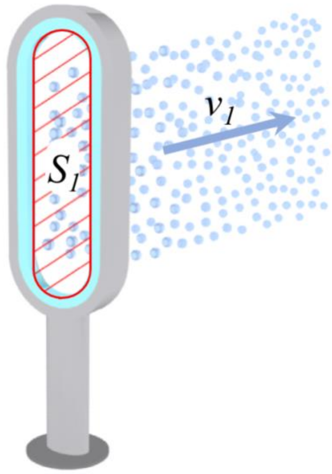

Fig. S1. Schematic diagram of the humidification system.

The mist concentration was calculated according to the following formula:

$$C_1 = \frac{Q \times \rho \times 10^3}{v_1 \times S_1 \times 3600 \times 10^{-4}}$$

where C_1 (mg m^{-3}) represents mist concentration, ρ (g cm^{-3}) is the density of water, Q (ml h^{-1}) is the mist load, v_1 (m s^{-1}) is the wind speed and S_1 (154.7 cm^2) is the area of airstream.

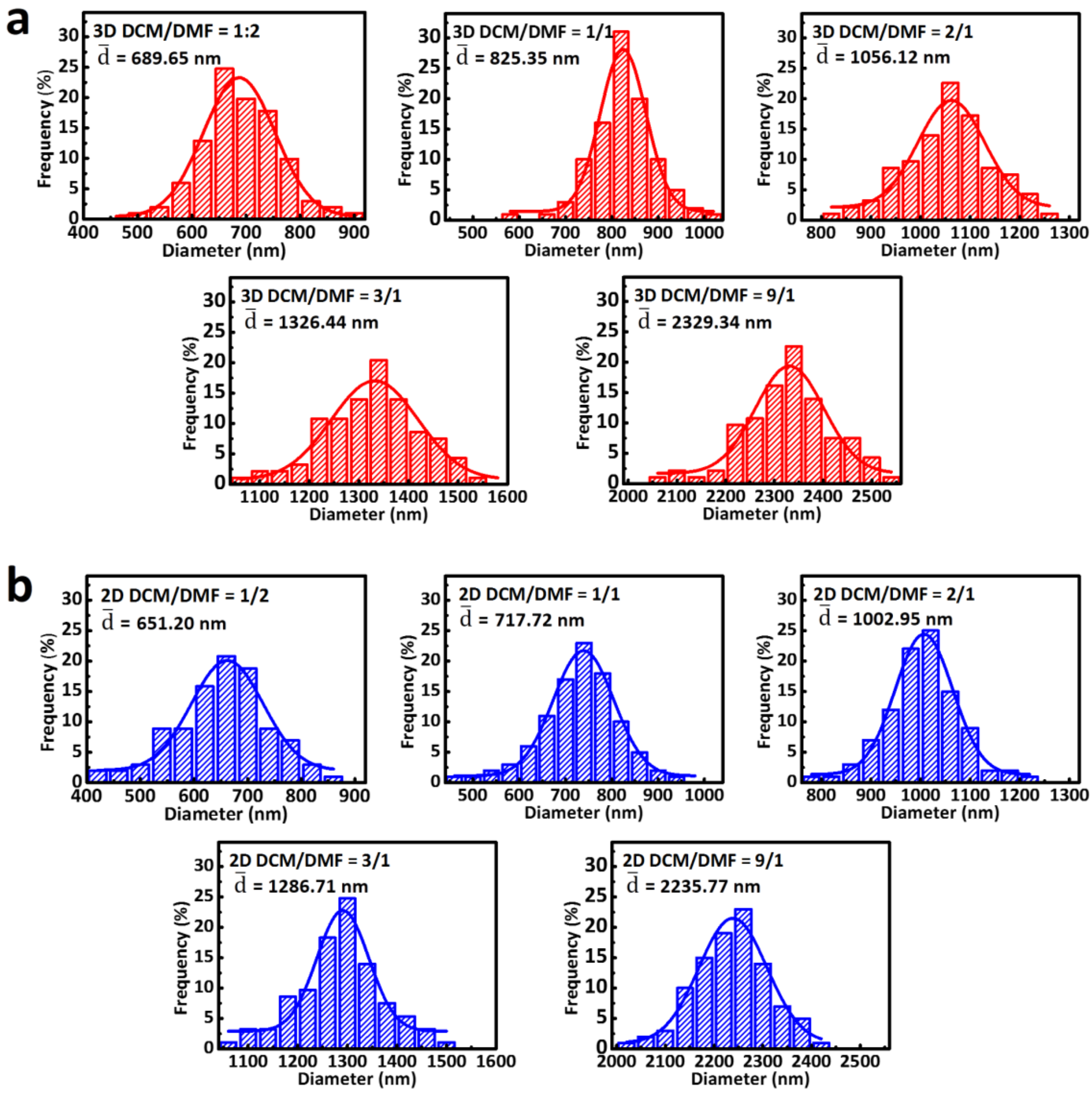

Fig. S2. (a) Diameter distributions of the 3D and (b) 2D fibre assemblies electrospun at different DCM/DMF ratios ($\bar{d}$ represents the average diameter of the fibres).

Table S1. Physical parameters of 3D and 2D CAB fibre assemblies.

Items	**3D**	**2D**
D_0 (mg cm^{-3})	**1250**	
D_1 (mg cm^{-3})	**9.5**	**189.6**
Porosity (%)	**99.24**	**84.832**

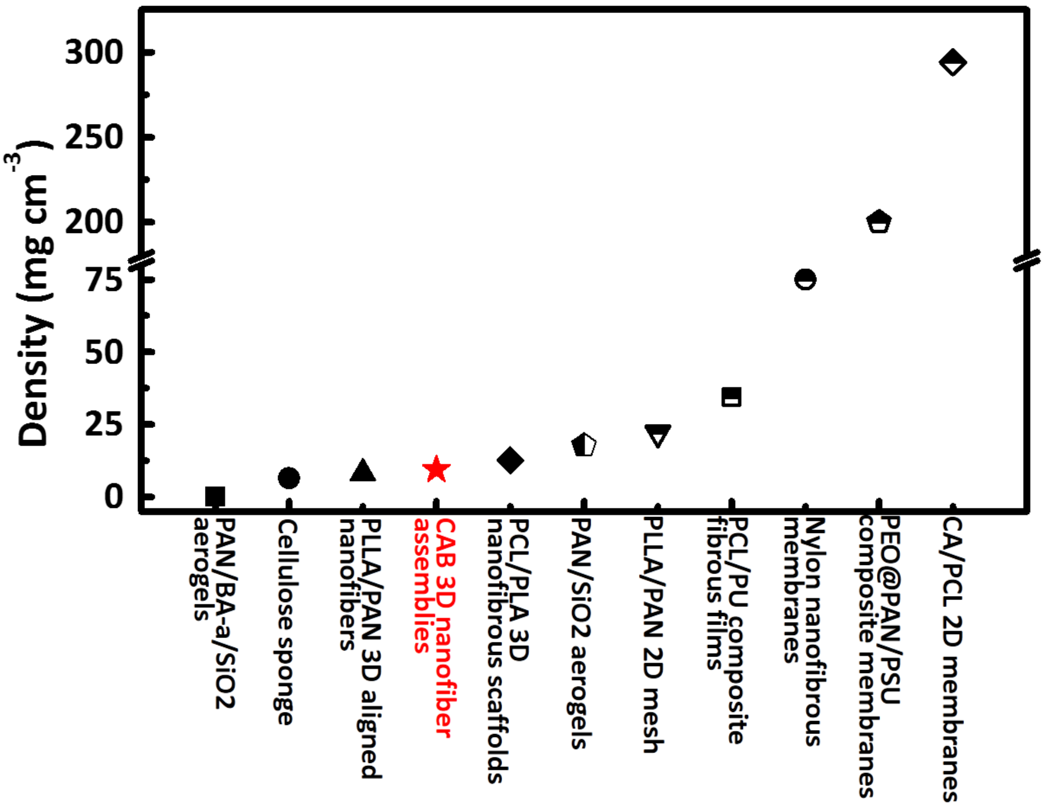

Fig. S3. Comparison of the density among previously reported several materials, including PAN/BA-a/SiO_2 aerogels,[1] cellulose sponge,[2] PLLA/PAN 3D aligned nanofibres,[3] PCL/PLA 3D nanofibrous scaffolds,[4] PAN/SiO_2 aeroges,[5] PLLA/PAN 2D mesh,[3] PCL/PU composite fibrous films,[6] nylon nanofibrous membranes,[7] PEO@PAN/PSU composite membranes,[8] CA/PCL 2D membranes.[9]

Table S2. Concentration of DCM vapor at different suction speeds.

v_2 (m s^{-1})	Δm (mg)	C_2 (mg m^{-3})
1	**6742.8**	**2247.6**
2	**13870.1**	**2311.6**
3	**21882.9**	**2431.4**
4	**32675.3**	**2722.9**
5	**42988.1**	**2865.9**

The length of the solution tank at moving direction of the conveyor belt is 5 cm and the belt moves 2.5 cm for every 30 min. Therefore, the bonding time of fibre assembly is ~ 60 min, and the bonding degree can be adjusted by simply varying the suction speed. The concentration of solvent vapor (C_2) is calculated according to the following formula:

$$C_2 = \frac{\Delta m}{10 \times v_2 \times S_2 \times 10^{-4} \times 60}$$

where Δm (mg) is the weight loss of solvent after volatilizing for 10 minutes at a certain fan speed, v_2 (m s^{-1}) is the suction fan speed and S_2 (50 cm^2) is the open area of solution tank.

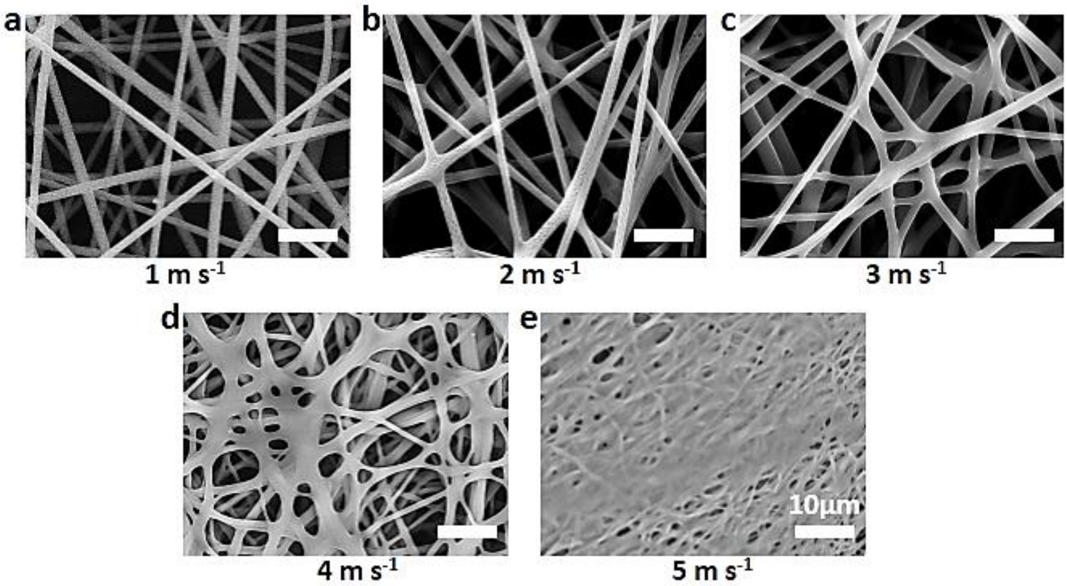

Fig. S4. SEM images showing the bonding degree of fibre assemblies under various suction speeds.

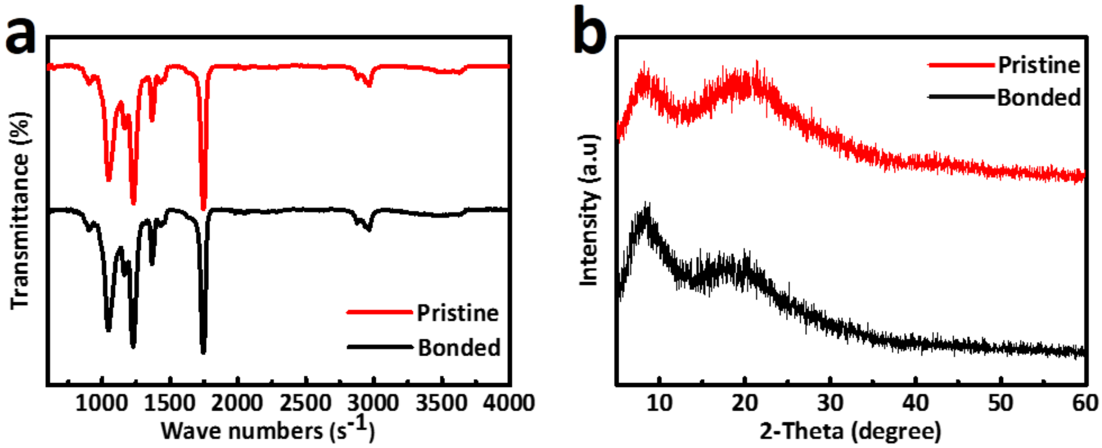

Fig. S5. (a) FT-IR spectra and (b) XRD patterns of 3D CAB fibre assemblies before and after DCM vapor bonding.

Table S3. Water flux, hydrostatic pressure, dust holding weight and dust holding capacity of 3D and 2D CAB fibre assemblies.

Items	3D	2D
Water flux (L m^{-2} h^{-1})	**334.38**	**0**
Hydrostatic pressure (mmH_2O)	**12.3 ± 1.1**	**65.9 ± 0.6**
($G_1 - G_0$) (g)	**0.0239 ± 0.0039**	**0.0145 ± 0.0021**
Dust holding capacity (g m^{-2})	**2.39**	**1.45**

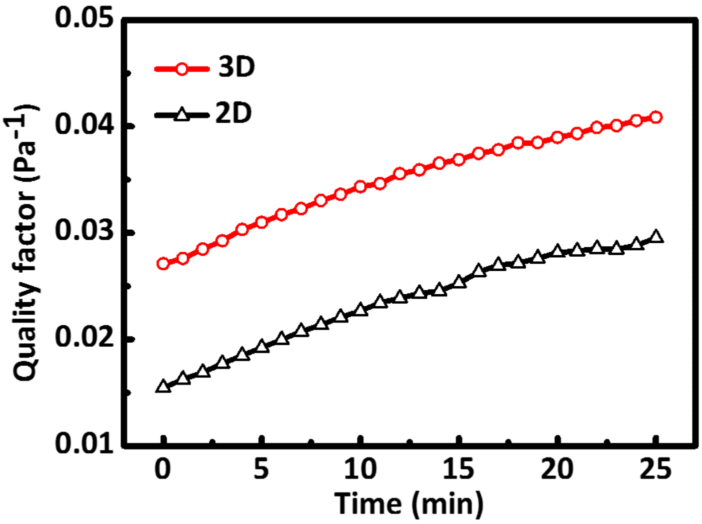

Fig S6. The relationship between filtration time and QF of 3D and 2D CAB fibre assemblies.

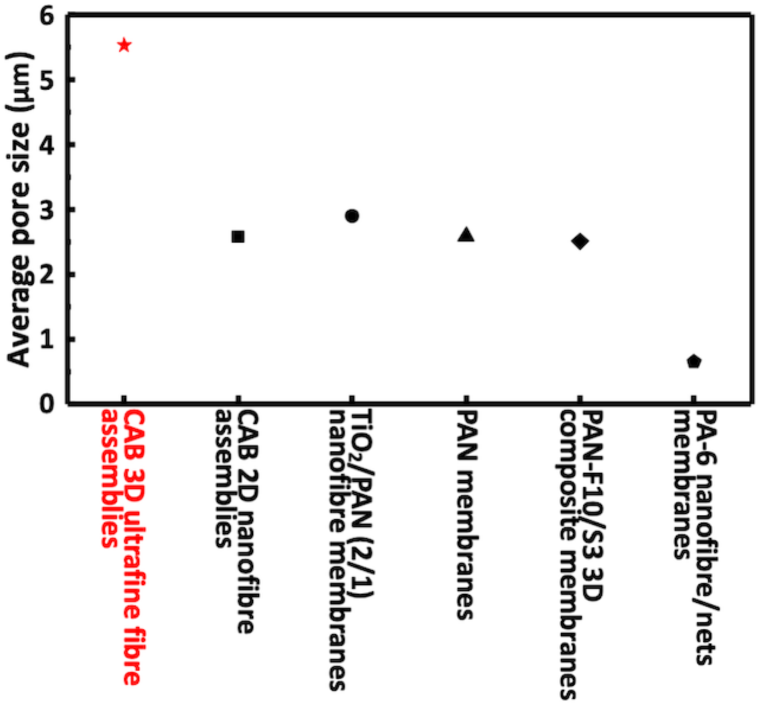

Fig S7. Comparison of average pore size between our 3D fibre assembly and previously reported porous materials by electrospinning, including TiO_2/PAN (2/1) nanofibrous membranes,[10] PAN membranes,[11] PAN-F10/S3 3D composite membrane,[12] PA-6 nanofibre/nets membrane.[13]

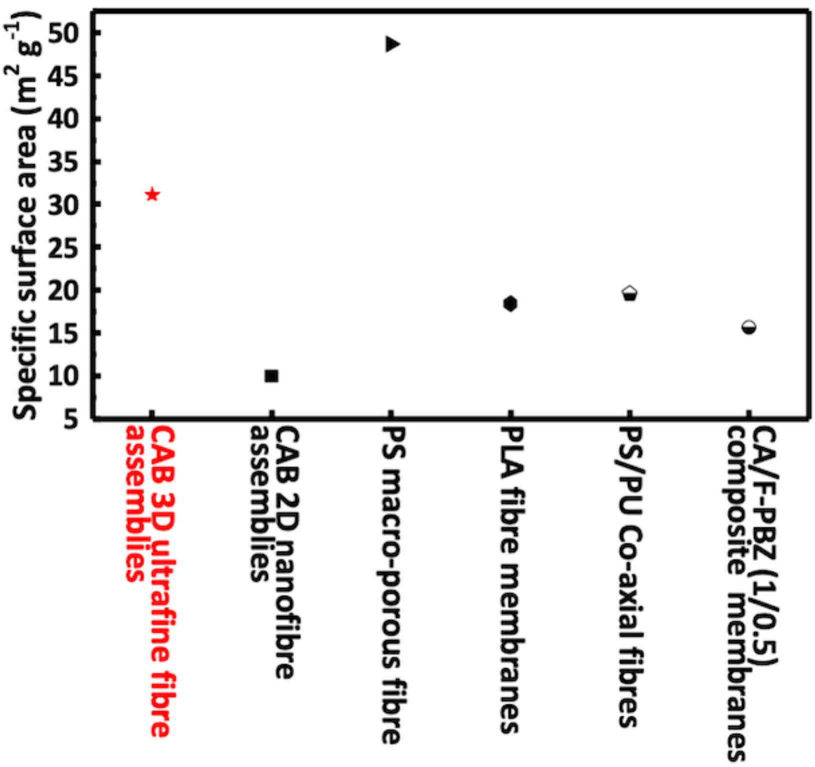

Fig S8. Comparison of specific surface area between our sample and previously reported porous materials prepared by electrospinning, including PS macro-porous fibres,[14] PLA fibres membrane,[15] PS/PU Co-axial fibres,[16] CA/F-PBZ (1/0.5) composite membrane.[17]

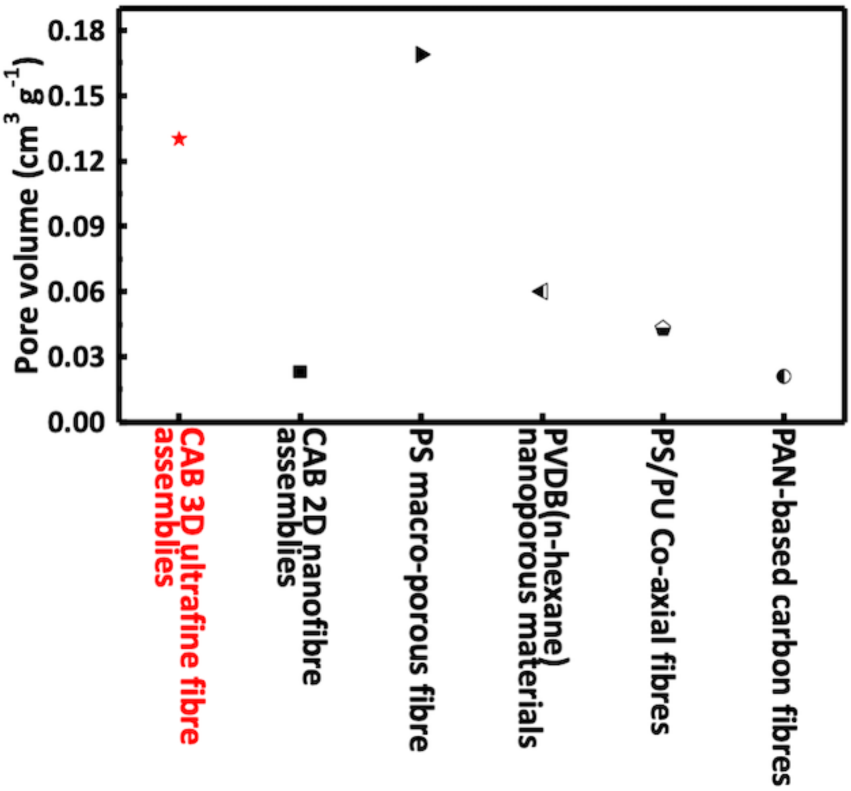

Fig S9. Comparison of the pore volume between our sample and previously reported porous materials prepared by electrospinning, including PS macro-porous fibres,[14] PDVB(n-hexane) nanoporous materials,[18] PS/PU Co-axial fibres,[16] PAN-based carbon fibres.[19]

Table S4. Electric charges of CAB, PMMA, PS, PLLA prepared by 0.5 h of electrospinning

Polymer type	CAB	PMMA	PS	PLLA
Electric charge (V)	**- (3.75±1.02)**	**- (3.21±0.87)**	**- (3.07±0.99)**	**+ (2.69±0.72)**

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