Electronic Supplementary Material (ESI) for Materials Advances.

Supporting information

Flexible Percolation Fibrous Thermal Insulating Composite Membrane for Thermal Management

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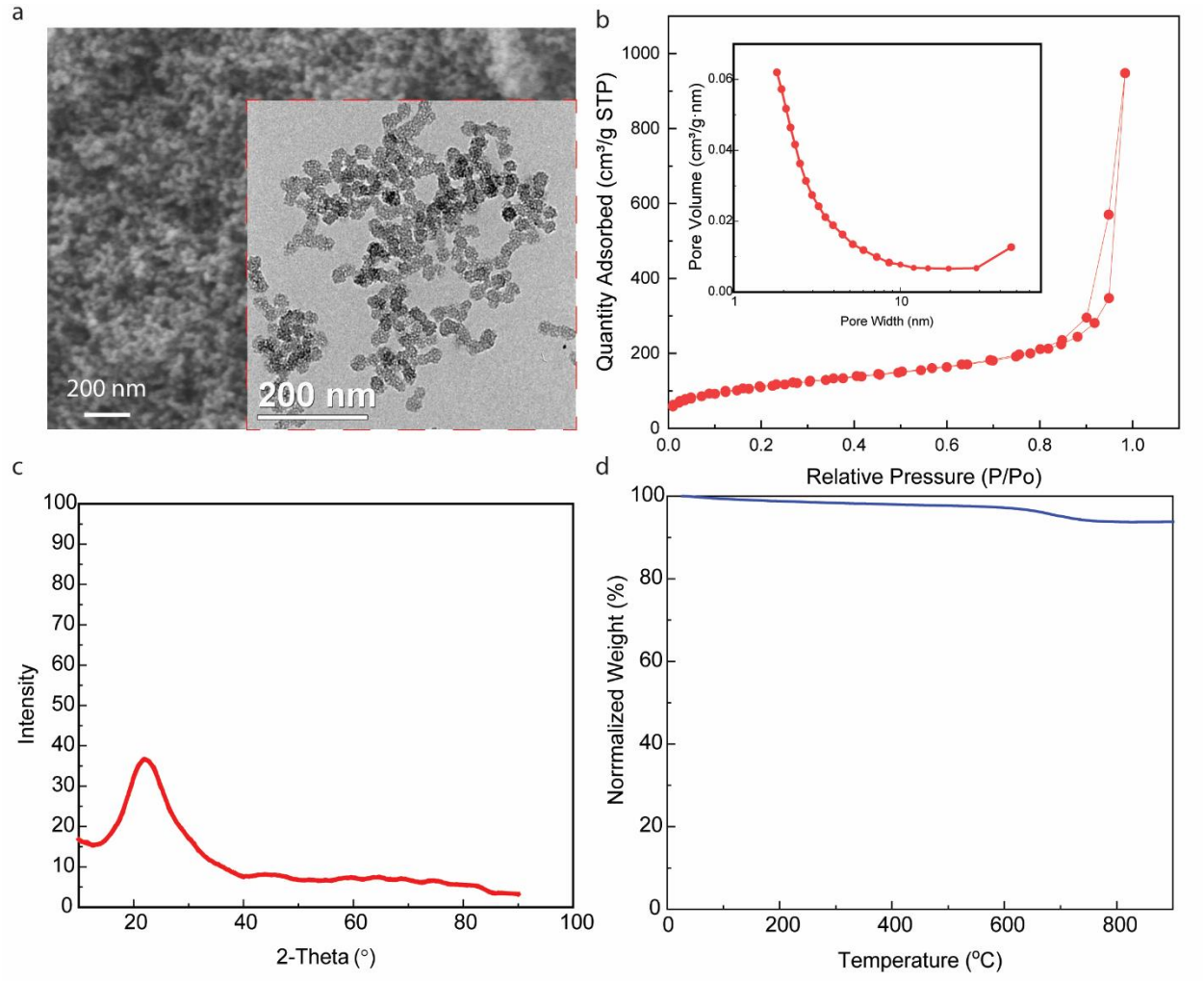

Figure S1. (a) SEM image of porous silica materials. The inset TEM image showing the mesoporous silica networks. (b) Nitrogen adsorption−desorption isotherms of the powders by the Brunauer−Emmett−Teller (BET) theory. The inset is pore size distribution by the BJH method. (c) XRD spectrum of powders. (d) TGA of porous powder-fibers composite.

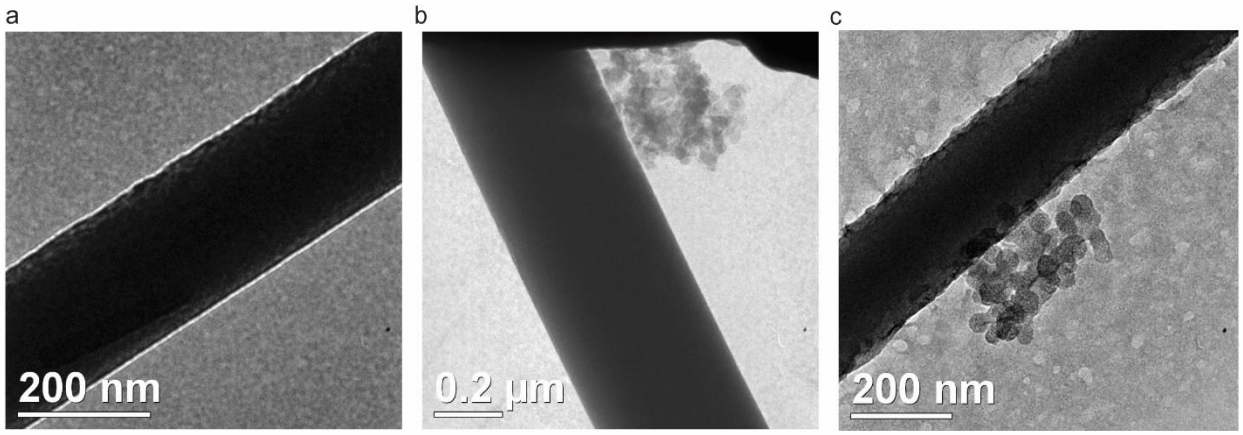

Figure S2. TEM images of fiber-porous silica powders. The fiber diameter is hundred nanometers, and the clean surface indicate the little powders coating without acid treatment.

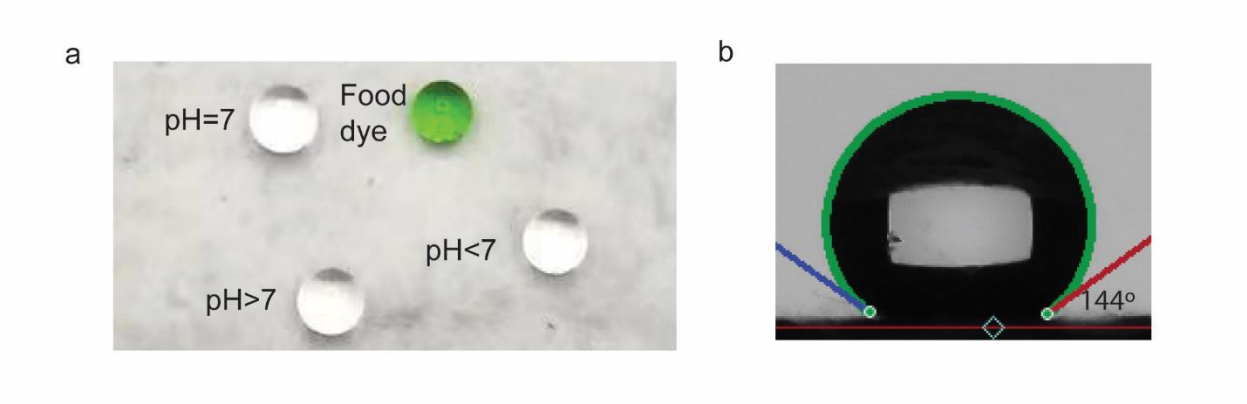

Figure S3. Hydrophobic performance of membrane. Water contact angel of 144° and the different pH solution resistance.

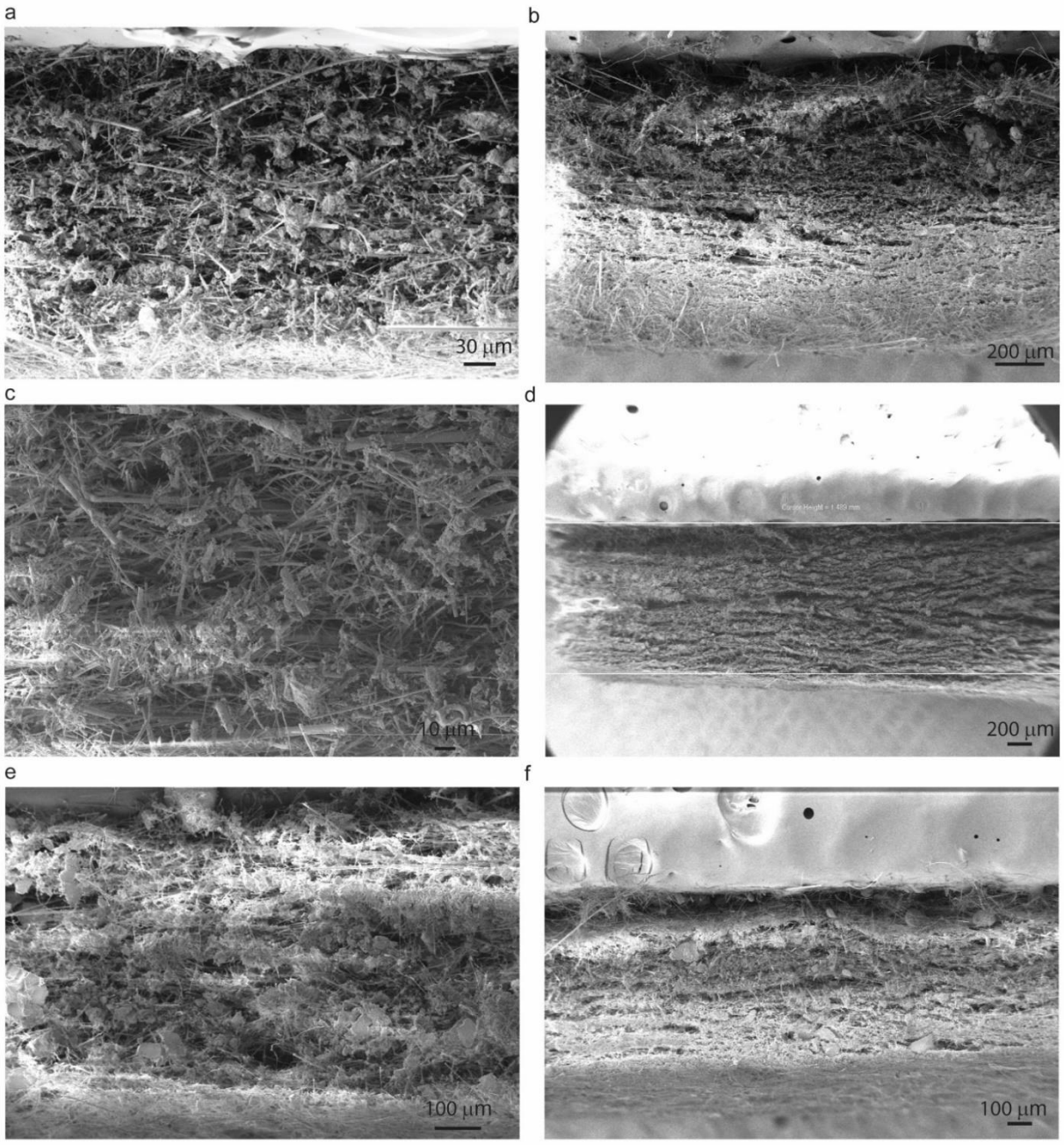

Figure S4. Cross-section SEM images of different composite membranes. (a) 33 wt% porous silica with thickness of 0.3 mm, (b) 33 wt.% porous silica with thickness of 0.9 mm. (c) 50 wt% porous silica with thickness of 0.3 mm, (d) 50 wt.% porous silica with thickness of 1.3 mm. (e) 67 wt% porous silica with thickness of 0.3 mm, (f) 67 wt.% porous silica with thickness of 0.9 mm.

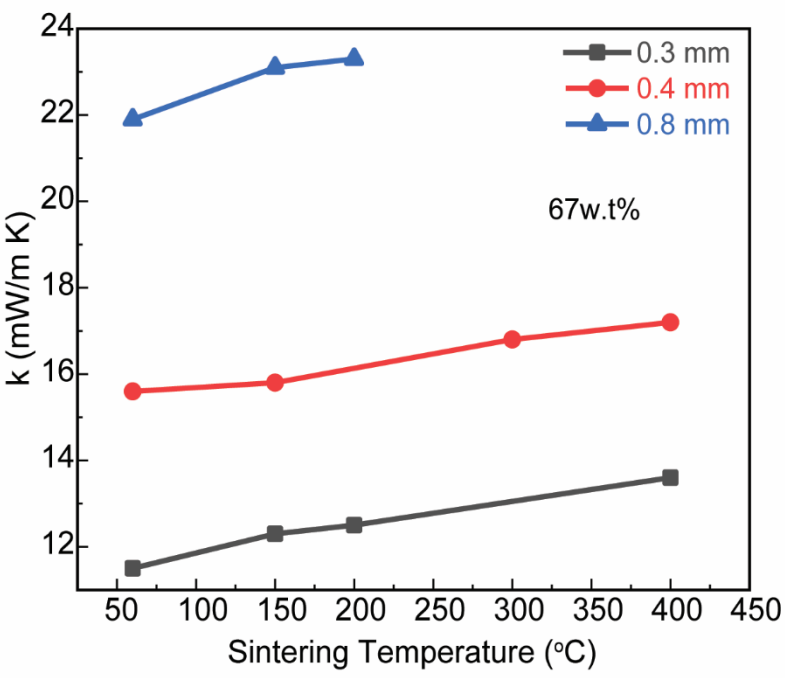

Figure S5. Sintering temperature vs. thermal conductivity of membranes with 67 wt.% pure porous silica and with 0.8 mm thickness. The higher temperature would cause a higher thermal conductivity.

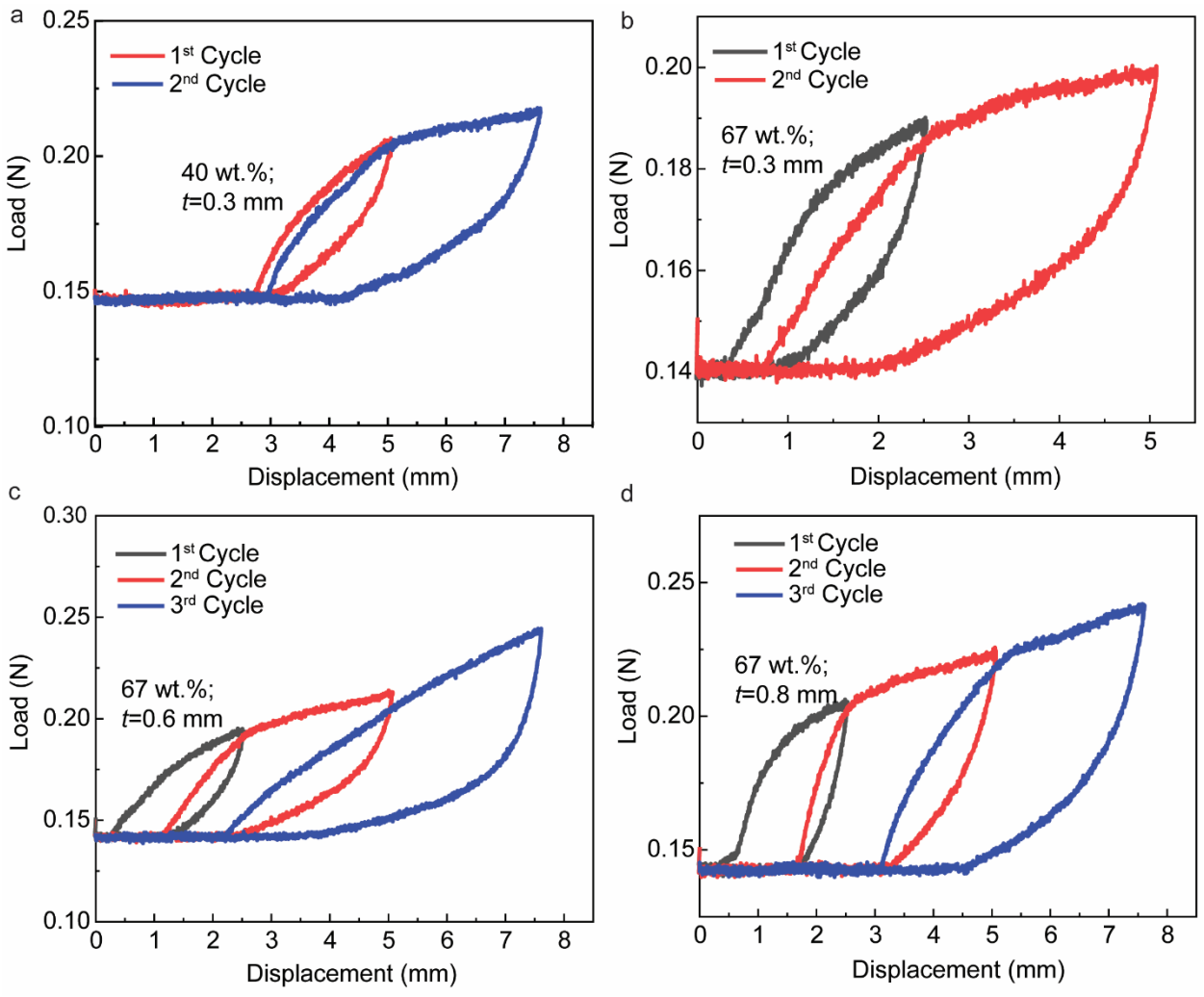

Figure S6. Multiple load-displacement cycles of composite membranes with (a) 40 wt.% porous silica and with thickness of 0.3 mm. (b-c) 67 wt.% porous silica materials and with thickness of 0.3mm, 0.6 mm, and 0.8 mm.