SUPPLEMENTARY DATA

Multifunctional, Flexible Electrospun Polydimethylsiloxane (ePDMS) Membranes for Soft Robotics Applications and Photocatalytic Conversion Platforms.

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S1. Effect of heat treatment on the characteristics of ePDMS

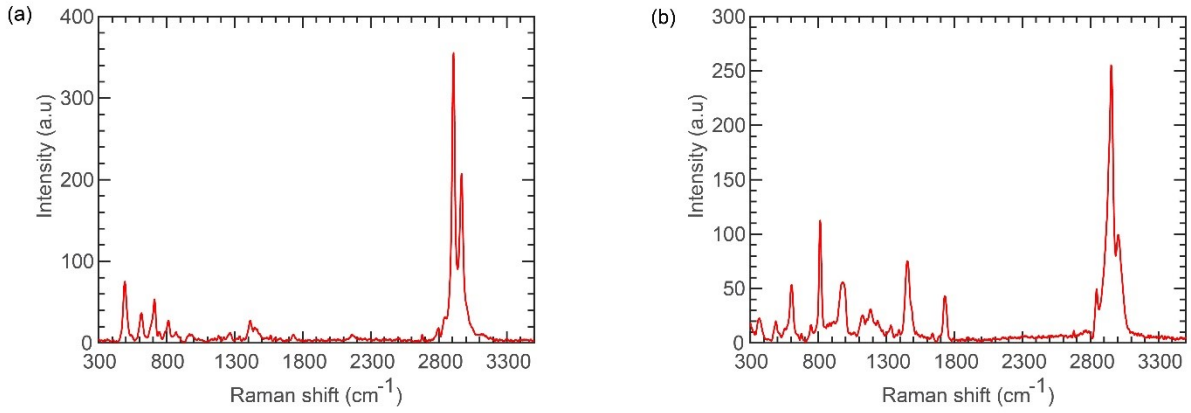


Figure S1. Raman Spectrum analysis of (a) pristine PDMS and (b)PMMA

In Figure S1, (a) corresponds to the Raman peaks obtained for pristine PDMS. As we can see, each peak corresponds to the characteristics functional peaks by which we can compare the eBHT membrane and eAHT membrane Raman peaks [Figure 1 (e) & (g)]. The 460 cm^{-1} and 489 cm^{-1} peaks correspond to the Si-O-Si bending vibrations and symmetric stretch, respectively. The C-Si-C symmetric stretching vibration appears at around 709 cm^{-1}. And at around 865cm^{-1}, the asymmetric stretching vibration of Si-CH3 occurs. The Si-CH2 twisting

vibration appears at around 1300-1350 cm^{-1}. The C-H asymmetric bend appears at 1411cm^{-1},2906 cm^{-1} peak representing the C-H symmetric stretching bond.

The peak at 2842 cm^{-1} corresponds to the asymmetric stretching vibration of the methyl (-CH3) groups in the PMMA polymer chain, while the peak at around 1730 cm^{-1} corresponds to the vibrational mode of the carbonyl group (C=O) present in the sample molecule. The peak at around 1452 cm^{-1} corresponds to the bending vibration of C-H bonds in the a-CH3 (alpha-methyl) group and/or O-CH3 (methoxy) group present in PMMA. 972 cm^{-1} corresponds to the symmetric bending vibration of the methyl (-CH3) groups. The peak at around 810 cm^{-1} corresponds to the stretching vibration of the C-O-C linkage present in the sample. The peak at around 600 cm^{-1} corresponds to the stretching vibration of the C-COO and C-C-O bonds present in the sample molecule [Figure S1 (b)].

S2. Contact angle measurement of As-ePDMS & HT-ePDMS

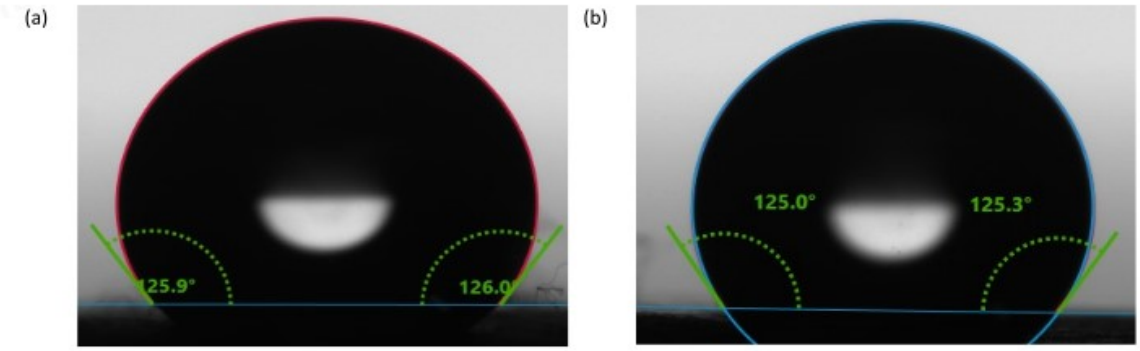


Figure S2. Water contact angle measurement of (a) AS-ePDMS and (b) HT-epDMS

S3. Shrinkage behavior of ePDMS:

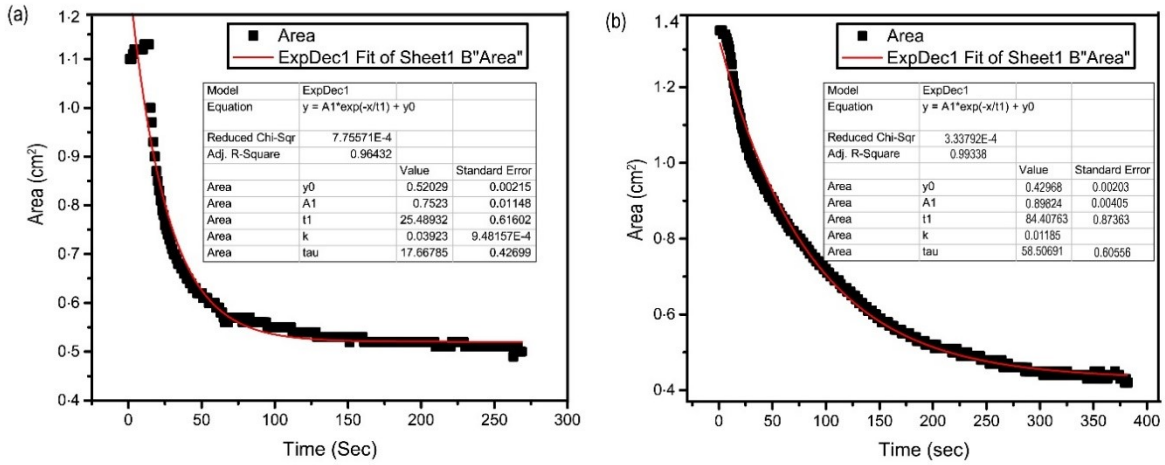


Figure S3. a) Area as a function of time of ePDMS membrane shrinkage in EtOH which is fitted with the curve with the function of Exponential Decay using the software Origin Pro 9. (b) Area as a function time of ePDMS membrane shrinkage in IPA which is fitted with the curve with the function of Exponential Decay using the software Origin Pro 9.

Figure S3 (a) & (b) corresponds to the plot of area reduction of e PDMS membrane in EtOH and IPA respectively with respect to time. As is clearly visible the membrane size we took for the shrinkage analysis is (a)1.2cm x 1.2 cm in the case of EtOH and (b)1.37 cm x 1.37 cm in the case of IPA respectively. We have plotted the respective graphs using the MATLAB software. After plotting the graph, we found that the membrane is shrinking in an exponential trend. So, to analyze the area reduction, half-life, and decay constant we have fitted the curve using the Model; Exponential Decay 1 from the software Origin Pro 9.

With the help of the equation, $A_{rel} = C_1 \times e^{\left(-\frac{x}{t_1}\right)} + C_2$, we were able to find out the half-life and decay constant. From Figure (a) we can say that the half-life and decay constant of the ePDMS membrane in EtOH with respect to time is 17.667 sec and 0.03923 respectively. The other parameters such as A1, Y0, and t1 with standard errors were calculated automatically and depicted in the inset of Figure S3 (a). Likewise in Figure S3(b) the half-life and decay constant of the ePDMS membrane in EtOH with respect to time are 58.50691 sec and 0.01185 respectively. The other parameters such as A1, Y0, and t1 with standard errors were calculated automatically and depicted in the inset of Figure S3 (b).

This method was continued 3 times and the half-life (τ) values was calculated from each plot by fitting the curve. By taking the mean and standard deviation, the half-life comparison of ePDMS in EtOH vs IPA with error bars was plotted [Figure 2 (h)].

S4. Mechanism of intermittent heat treatment for effective PMMA reduction.

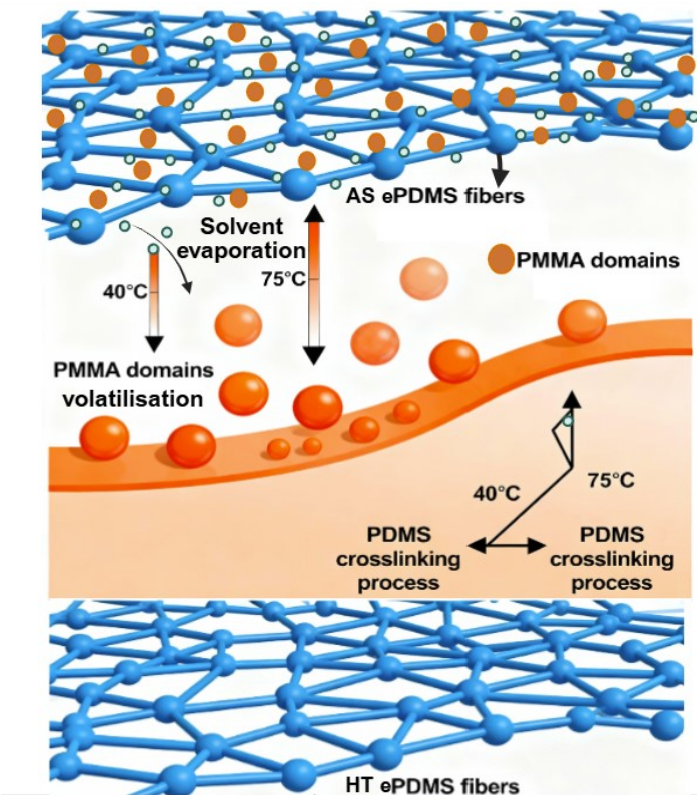


Figure S4.The mechanism of heat treatment involved in PMMA reduction from AS ePDMS membrane.

S5. FTIR of AS ePDMS and HT ePDMS

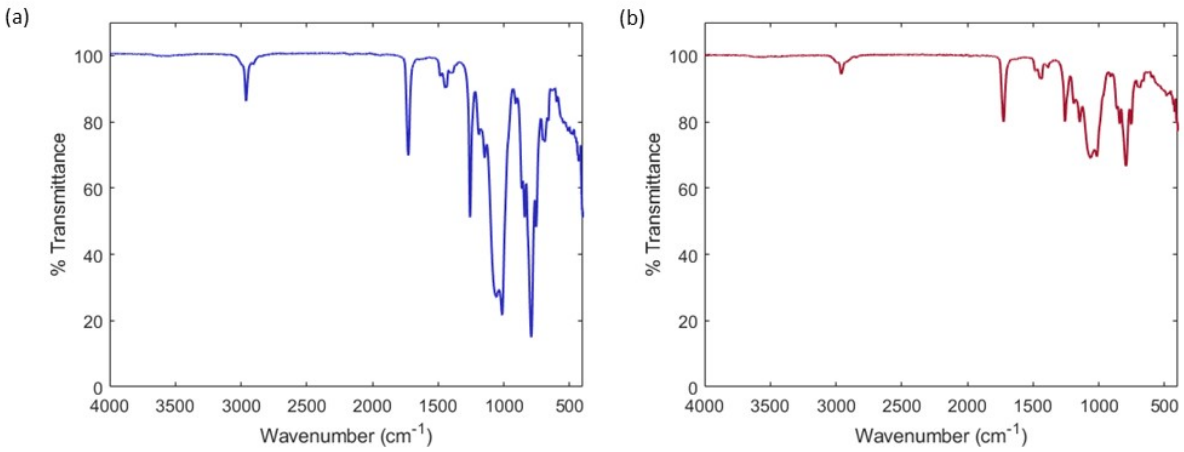


Figure S5. Fourier Transform Infrared spectroscopy (FTIR) of (a) AS electrospun PDMS PMMA membrane (AS ePDMS) and (b) Heat-treated PDMS membrane (HT ePDMS)

S6.SEM Image of electrospun PDMS membrane (AS ePDMS)

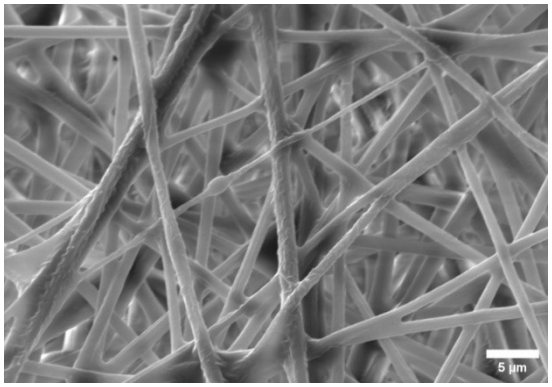


Figure S6.SEM Image of electrospun PDMS membranes before heat treatment Scale bar: 5µm

S7.SEM Image of heat treated electrospun PDMS membrane (HT ePDMS)

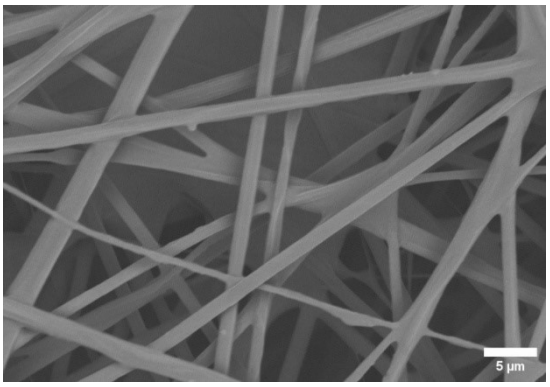


Figure S7.SEM Image of Electrospun PDMS membrane after heat treatment. Scale bar: 5µm

S8. Functional traps using ePDMS

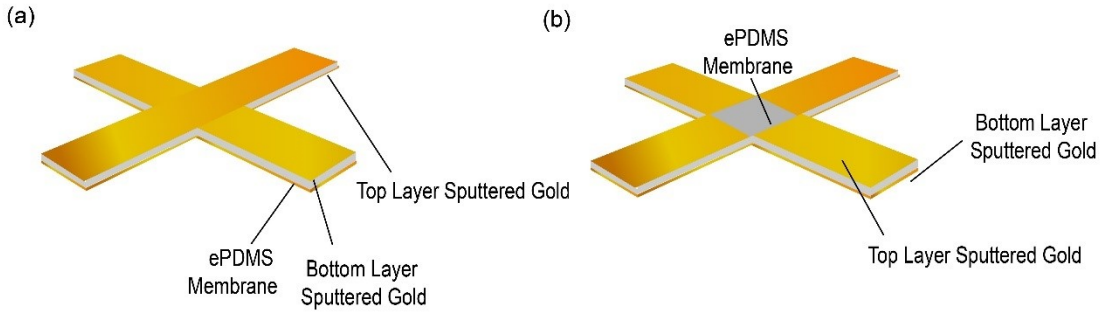


Figure S8. Representation of ePDMS membrane for functional traps; (a) depicts the bottom portion of the membrane (FLAP-F) and (b) depicts the top layer of the membrane (FLAP-T).

In Figure S8,(a)represents the cross-shaped cut ePDMS membrane, which is gold sputtered for 30sec, the gold was sputtering uniformly on all the sides with full coverage. This portion was selected as the bottom side which will be in contact with the solvent and since this is facing towards the solvent and comes in the bottom side, we named this as FLAP-F. (b) represents the cross-shaped cut ePDMS membrane, which is gold sputtered for 30sec, the gold was sputtering uniformly only on all four sides with the centre portion unsputtered. This portion was selected as the top side which will be away from the solvent and since this is facing away from the solvent and comes in the top side, we named this as FLAP-H. Briefly, (a) and (b) depicts a single ePDMS membrane cut in a cross shape with two sides top (FLAP-F) and bottom (FLAP-T) depicted separately.

S9. Experimental validation of Venus fly trap like ePDMS membrane

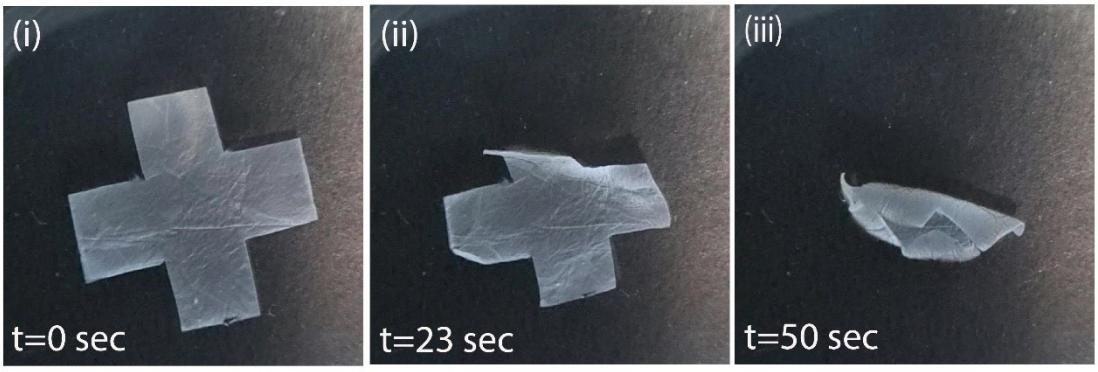


Figure S9. (i), (ii) & (iii) depict the various frames extracted from the experiment of functional traps using cross-shaped ePDMS membranes (FLAP-H & FLAP-F) at different time intervals of 0 sec, 23 sec, and 50 sec respectively.

In the above figure S9, (i) represents the cross shaped cut membrane in EtOH at time, t=0 secs with FLAP-Ffacing the solvent side and e FLAP-H facing upwards, away from the solvent. At time, t=23 sec, the membranous flaps from four sides starts folding upwards towards the centre unsputtered region of FLAP-H. and at time, t=50 sec, the flaps from four sides almost completely fold towards the centre of FLAP-H resembling like a venus fly trap.

S10. Self folding behavior of the ePDMS membrane

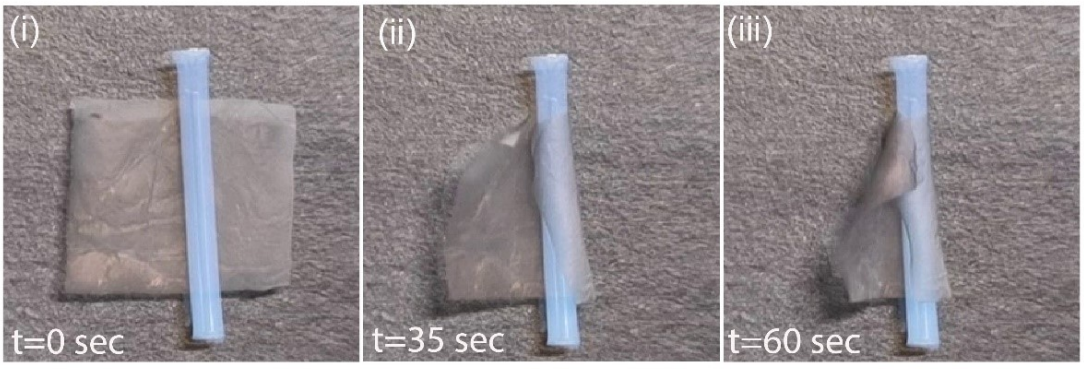
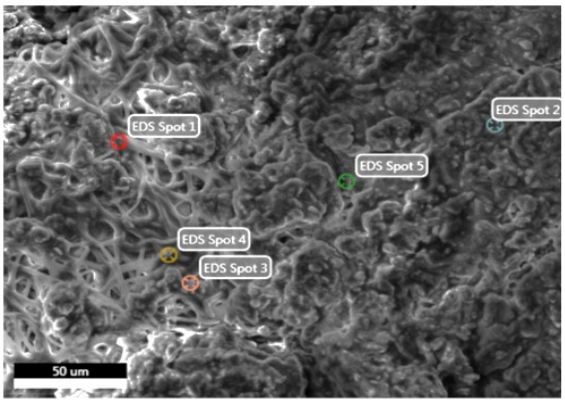


Figure S10. (i), (ii), and (iii) depict various frames extracted from the experimental video with different time rates of 0 sec, 35 sec and 60 sec respectively.

S11. SEM and EDS analysis of C_3N_4 coated HT-ePDMS membranes:

(a)



(b)

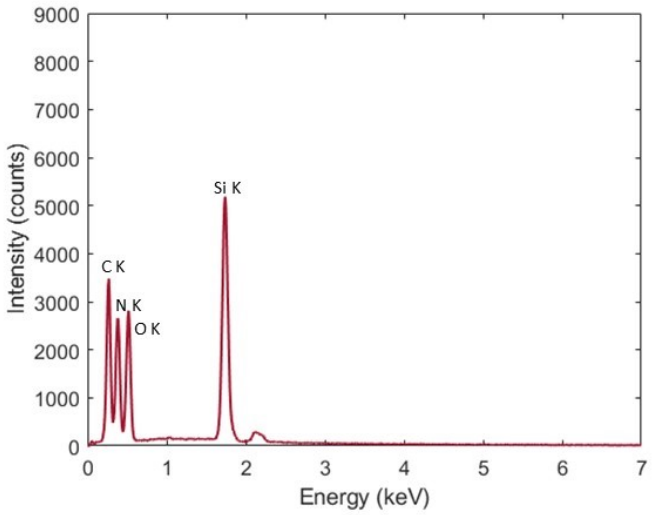


Figure S11.(a) corresponds to the Scanning electron microscopy (SEM) image of C_3N_4 coated HT-ePDMS membranes, and (b) shows the EDS mapping of the elements validating the presence of C_3N_4 on the PDMS membrane.