Supporting Information

Self-Healing Hydrogel Pore-Filled Water Filtration Membranes

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Summary. Experimental procedures (Figures S1-S3), conductivity measurements (Figure S4), swelling ratio, MWCO and grafting percentage measurements (Figures S5-S8), control rejection measurements (Figure S9), continuous flux measurements (Figure S10) and photographs of PAMPS bulk hydrogels (Figure S11-S12).
Figure S1. Removal of excess monomer solution from fully soaked substrates before exposure to UV light. The fully soaked substrates are placed between two polyethylene terephthalate transparency slides and the slides are pressed tightly together with a roller.

Figure S2. Experimental steps and setup for UV irradiation of soaked membranes. The chamber was equipped with six 4-W UV-A lamps (Philips. Co., USA) with an intensity of 720 μW/cm². The membranes were placed 5 mm away from the lamps.
**Figure S3.** Experimental setup for membrane filtration with an Amicon 8010 stirred, dead-end filtration cell attached to a dispensing vessel and pressurized with nitrogen gas.

**Figure S4.** Conductivity measurements of water used to wash the pore-filled membranes after immersion in water overnight. The 1\textsuperscript{st} wash refers to the water that the membrane was immersed in overnight.
Figure S5. The swelling ratio of pore-filled membranes prepared with monomer solution concentrations of 5-25 wt% as a function of time when immersed in water. A dried membrane was immersed in water and its weight was measured periodically.

Figure S6. Rejection of fluorescein functionalized PEG molecules (Creative PEGWorks, Chapel Hill, NC) with decreasing molecular weight by pore-filled membranes prepared with 25 wt% monomer solution.
**Figure S7.** a) Mass increase of pore-filled membranes relative to the PES substrate before and after washing; b) fraction of monomer that remains grafted after washing.

**Figure S8.** The rejection of 50 nm microspheres by control polysulfone ultrafiltration membranes (PS-20, Sepro membranes Inc., Oceanside, CA) with a MWCO of 20 kDa. The membrane was damaged after the first filtration run.
**Figure S9.** Continuous measurement of flux through a sample pore-filled membrane during membrane damage. The pristine membrane’s flux is first established followed by stopping filtration to damage the membrane. The normalized and averaged values presented in Figure 6b are derived from raw mass flow measurements such as this one.

Flow through the circular perforation can be estimated using the classical Hagen-Poiseuille equation as follows.

\[ Q = \frac{\Delta p \times \pi \times r^4}{8\mu L} \]

where \( Q \) = flow rate through the damage, \( \Delta p \) = the pressure drop across the membrane, \( r \) = the radius of the damage, \( \mu \) = dynamic viscosity of water and \( L \) = the thickness of the membrane. Because the flow rate is related to \( r^4 \), even very small damages can result in a very large increase in permeability as shown in **Figure S10**.
**Figure S10.** Permeability of damaged membranes as a function of damage radius according to the Hagen-Poiseuille equation.

**Figure S11.** PAMPS bulk hydrogel self-healing. Bulk PAMPS hydrogel samples that are prepared without a cross-linker show strong self-healing property after being cut in half.
Figure S12. Heat induced polymerization of AMPS. AMPS undergoes homolytic polymerization simply upon heating to elevated temperatures. The counterion of the sulofonic group in AMPS, H+, acts as a catalyst that initiates polymerization.