Supplementary Information (SI) for New Journal of Chemistry.

Supporting Information

The preparation of PAA-DM/ nickel foam interpenetrating network composite material and its application in oil-water separation

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S1. Method to test the water-absorbing quality and swelling capacity of hydrogels

At 20°C, 500 mL of distilled water was added into a set of beakers. Then 100 mg of the fully dried PAA-DM hydrogel were added to the beakers. Take it out at a certain interval, dry the water on the surface with filter paper, and weigh it with an electronic scale until the weighing result no longer changes. The swelling rate changes of the hydrogels were calculated with the following formula：

$$S\% = \frac{m_{\mathrm{s}} - m_{\mathrm{d}}}{m_{\mathrm{d}}} \times 100\%$$

Where S% is the swelling ratio, m_{s} is the mass of the hydrogel after water absorption and expansion, and m_{d} is the mass of the completely dried hydrogel.

S2. Microstructure of the material after cycling stability tests

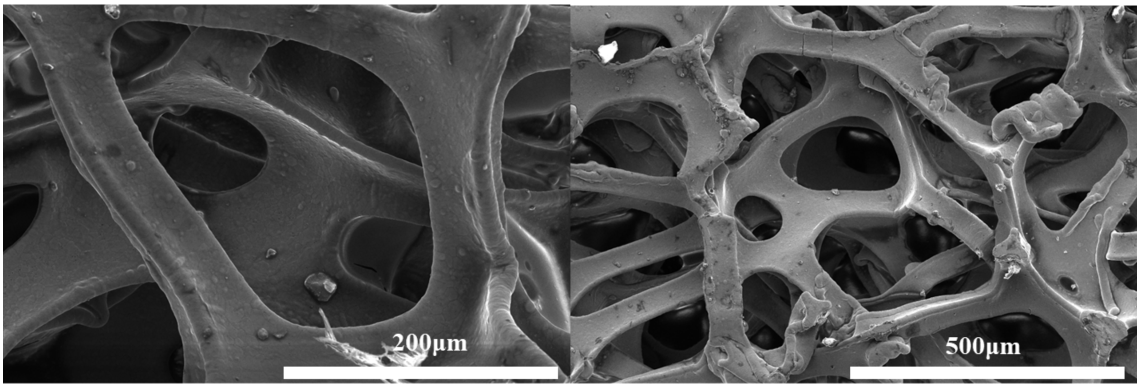

Fig. S1 SEM images of the HNIM-2 separation mesh after 30 cycles of separation

S3. Method to test the oil-water separation efficiency

Under room temperature, to test the separation efficiency of the oil-water separation mesh with special wettability, the net is pre-wet with water and fixed in a self-made oil-water separation device. The dyed oil-water mixture, mixed in a volume ratio of 1:1, is poured into the separation device for the oil-water separation test, and its separation efficiency and stability are measured. The separation efficiency is calculated as follows:

$$W\% = \frac{m_a}{m_b} \times 100\%$$

Where m_b is the weight of the oil before separation and m_a is the weight of the oil after separation.

S4. Method to calculate the water flux of separation material

We used a self-made oil-water separation device system (with an effective separation area of approximately 12.6 cm^2) to test the Water Flux of the prepared oil-water separation mesh. After coloring 150 mL of the oil phase with 4-methoxyazobenzene, it was mixed with an equal volume of water and poured into a filtration cup. It was observed that the water phase passed through the material rapidly, while the dyedoil phase was completely blocked above the material. The final result in the beaker was clear water without oil. The volume of water passing through the separation material and the time it took for the water to pass through were recorded to calculate the water flux of the material. The water flux of the separation mesh is calculated using the following formula:

$$J = \frac{V}{T \times A}$$

Where J is the membrane flux ($L/m^2 \cdot h$), V is the volume of water (L), T is the time taken for water to pass through (h), A is the effective membrane area (m^2).

S5. Supporting Video 1: Separation Process of cyclohexane from water

S6. Supporting Video 2: Separation Process of 1,2-dichloroethane from water

S7. Supporting Video 3: Separation Process of vegetable oil from water