A Robust and Highly Elastic Fluorinated Graphene/Poly(ethyl acrylate) Composite Sponge for Efficient Water/Oil Separation

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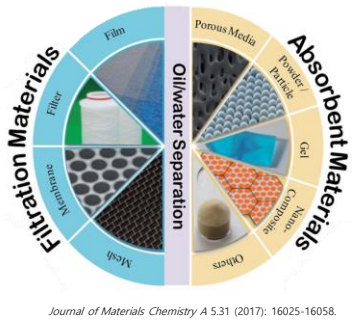
Introduction

▣ About Water/Oil Separation



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Produces a lot of wastewater! ***Water/oil separation is the key!***

- A lot of industries produce oily wastewater.
- Among the numerous method, the 'absorption method' is the most effective.
  → No expense & specialized equipment, very quick, effective

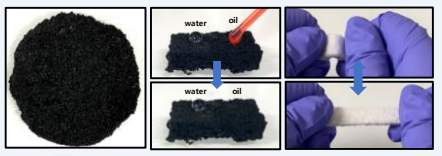
▣ Recent Studies

PDMS Sponges

ACS applied materials & interfaces 3.12 (2011): 4552-4556.

Low mechanical properties (low recyclability) · Expensive price · High viscosity & low processability

Our Work



High mechanical properties (high recyclability) · Cheap price · Low viscosity & high processability

- Most of studies used PDMS as polymer matrix.
- However, PDMS possess many disadvantages.
  → **low stretchability & flexibility**, **expensiveness**, **high viscosity** etc.
- To solve these problems, we employed stretchable and flexible acrylate monomer for W/O separation sponges.

Experiment

▣ Materials

- Sodium chloride, DI water, graphene nanoplatelet (thickness 1-2nm, width <2μm), *1H,1H,2H,2H*-perfluorodecyltriethoxysilane (FS), ethyl acrylate (EA), poly(ethylene glycol)dimethacrylate (PEGDMA), azobisisobutyronitrile (AIBN)

▣ Part A, Salt Frame

1) Make salt paste by adding a little water.
2) Pour paste into the mold and evaporate the water at 80℃.
3) Remove the salt frame from the mold.

▣ Part B, Fluorinated Graphene

1) Disperse graphene nanoplatelet in NMP.
2) Add FS to the graphene dispersion. (Graphene 1g : FS 0.01g)
3) After stirring for 24 hours, evaporate the NMP completely.

▣ Part C, Polymer Matrix

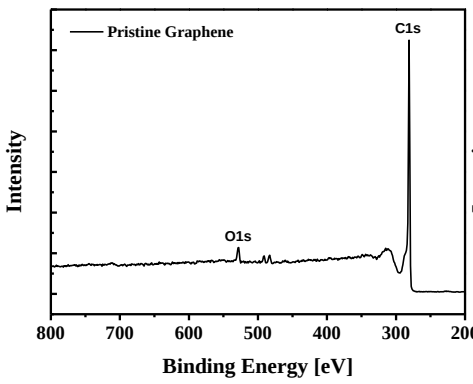
1) Mix monomer, crosslinker, thermal initiator (50:1:1 weight ratio) and stir for 30 minutes.
2) Add fluorinated graphene to the solution (1) and stir for 2 hours.
3) Pour the solution (2) into the salt frame, and cured in the vacuum oven for 24 hours.
4) After curing, remove salt frame using sonication.
5) Dry sponge completely.

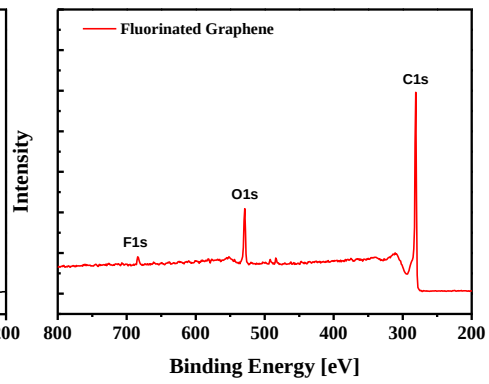
Salt Frame

FG Sponge

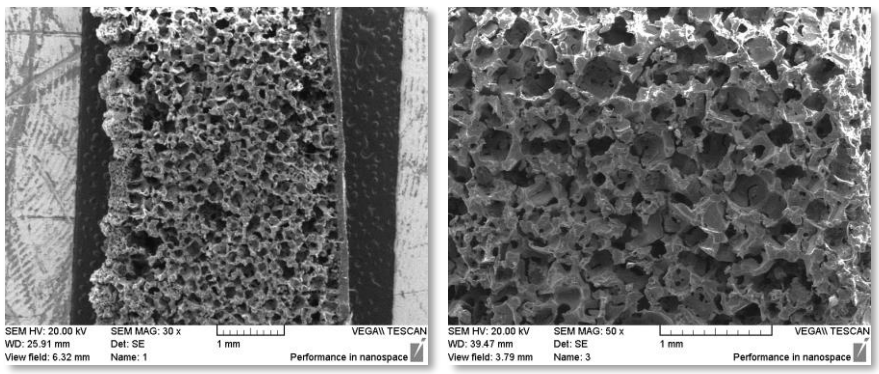
Result & Discussion

▣ X-ray Photoelectron Spectroscopy (XPS)

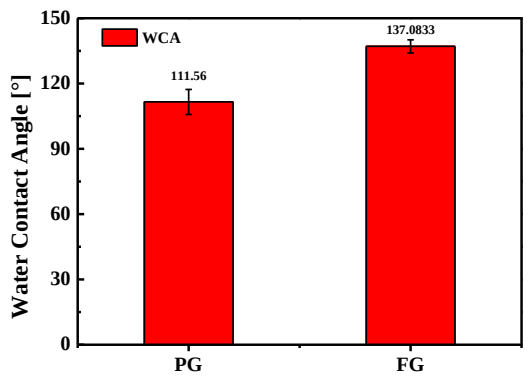




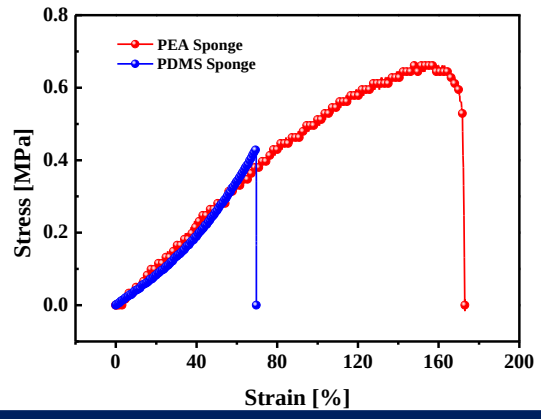
▣ Scanning Electron Microscope (SEM)



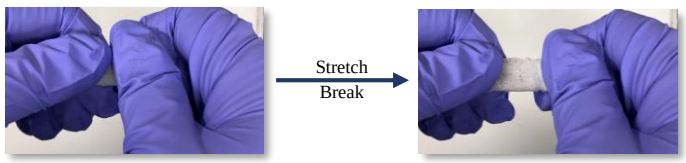
▣ Water Contact Angle (WCA)



▣ Ultimate Testing Machine



PDMS



PEA