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本人做学术报告登记目录

序号	时间	地点	学术报告题目	主持人
1	2019.11.30	青岛	生物质碳基复合MXene光热催化材料的制备及其海水淡化性能研究（开题报告）	王林
2	2020.11.30	青岛	生物质碳基复合MXene光热催化材料的制备及其海水淡化性能研究	王林
3	2021.12.2[illegible]	高密	3D氮掺杂碳网络MXene/PPA泡沫复合材料的制备及高效光热催化性能研究	刘植
4	2021.12.31	青岛	3D氮掺杂碳网络MXene/PDA泡沫太阳能蒸发器设计	刘敬权

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Encapsulation of MXene/polydopamine in nitrogen-doped 3D carbon networks with high photothermal conversion efficiency for seawater desalination

Yang Jin [a,c,d], Kai Wang [b], Shaoxiang Li [a,c,d,*], Jingquan Liu [b]

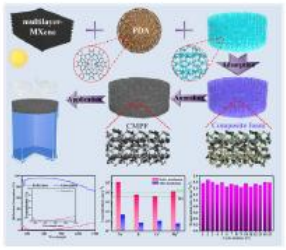
[a] College of Environment and Safety Engineering, Qingdao University of Science and Technology, Qingdao 266042, China
[b] College of Materials Science and Engineering, Institute for Graphene Applied Technology Innovation, Qingdao University, Qingdao 266071, China
[c] Shandong Engineering Research Center for Marine Environment Corrosion and Safety Protection, Qingdao University of Science and Technology, Qingdao 266042, China
[d] Shandong Engineering Technology Research Center for Advanced Coating, Qingdao University of Science and Technology, Qingdao 266042, China

HIGHLIGHTS

- 3D *N*-doped carbon networks encapsulated with mMXene and PDA NPs (CMPF) are prepared via multiple squeezing and thermal annealing.
- CMPF-2 shows efficient water transport capacity owning to the high nitrogen content.
- CMPF-2 has low thermal conductivity, strong hydrophilicity and good light absorbance.
- CMPF-2 exhibits excellent desalination ability and self-desalination ability.

GRAPHICAL ABSTRACT

A 3D *N*-doped carbon network encapsulated with mMXene and PDA NPs (CMPF-2) is prepared with a high evaporation rate of 1.598 kg m^{-2} h^{-1} under 1 sun illumination, and a photothermal conversion efficiency of 89.9%, which reveal the excellent desalination ability and desirable potential application prospect.



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ABSTRACT

With the rapid consumption of traditional fossil energy, the utilization of solar energy via photothermal conversion to obtain fresh water from seawater or wastewater should be a promising alternative to solve the shortage of energy resources. At present, evaporators based on diverse photothermal conversion materials have been developed, but most of them are still facing the drawbacks of complicated structure, complex preparation and poor salt resistance, which severely affect their broad practical applications. Multilayer-MXene (mMXene) and polydopamine (PDA) nanoparticles are two kinds of materials with excellent photothermal conversion efficiency. In this study, we loaded these two materials with optimized mass ratio into the thermally insulated and low-cost melamine foam, followed by simple annealing treatment to afford three-dimensional and self-floating carbonized MXene/PDA foam (CMPF) evaporators with high hydrophilicity, unpleasant thermal conductivity, and remarkable light absorbance. The evaporation rate of CMPF, as a result, could attain 1.598 kg m^{-2} h^{-1} under 1 sun (1 kW m^{-2}) irradiation while the photothermal conversion efficiency is calculated to be 89.8%. In addition, CMPF-2 displays excellent desalination ability, self-desalination ability, good cycle stability and reliable safety

* Corresponding author at: College of Environment and Safety Engineering, Qingdao University of Science and Technology, Qingdao 266042, China.
E-mail addresses: leeshaoxiang@126.com (S. Li), jliu@qdu.edu.cn (J. Liu).

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RESEARCH ARTICLE

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Chitosan/multilayered MXene Nanocomposites Loaded in 3D Nitrogen-Doped Carbon Networks for Seawater Desalination with Highly Efficient Photothermal Conversion

Yang Jin, Yujian He, Hen Wang, Shaoxiang Li, and Jingquan Liu**

Sunlight, as one of the inexhaustible green energy sources, is attracting rising attention, particularly with the rapid depletion of traditional fossil fuels nowadays. Chitosan (CHT) is an abundant natural product that can be converted into N-doped porous carbon which has a strong light absorption ability. Herein, chitosan is employed with the accordion-like multilayered mMXene (mMXene) to fabricate the 3D thermally insulated and low-cost composites using melamine foam (MF) as a template. The obtained MF/CHT/mMXene (MCM) composites with different mass ratios of mMXene/chitosan are then subject to a simple annealing treatment at 500 °C for 2 h to afford 3D and self-floating carbonized carbonized MF/CHT/mMXene (CMCM) composites. The CMCM-1 obtained with mass ratio of CHT/mMXene at 1:1 displays low thermal conductivity, high hydrophilicity, and good light absorbance. When it is utilized as the evaporator of pure water and seawater, its evaporation rates can reach at 1.554 and 1.428 kg m^{-2} h^{-1} under 1 kW m^{-2} irradiation and the photothermal conversion efficiency can reach at 89.8%. In addition, the CMCM-1 composite also displays excellent desalination ability, self-desalination ability, good cycle stability, and reliable safety performance. Combining these advantages, CMCM-1 composite may have potential practical applications for seawater evaporation and wastewater treatment, etc.

1. Introduction

The lack of freshwater has become a critical issue in almost all the countries in the world. Desalination of the never exhausted seawater can be an alternative promising strategy to tackle the issue of drinking water shortage.[1–3] Many researchers have designed sorts of desalination strategies for seawater, such as reverse osmosis, material filtrations, and ultrafiltration membrane, whereas these strategies mostly have the drawbacks of high price, complicated processes, and unaffordable consumption of energy, etc. As a control, photothermal evaporation (PE) can fully utilize solar light to evaporate water into vapor at high energy conversion efficiency even up to 100%. Moreover, PE can be realized no matter whether the light is strong in summer or light is weak in winter, thus has a lot of merits. These merits of PE are really eye-catching and have attracted many researchers from both industrial and academic realms to take up relevant studies.[4–6]

Since their discovery in 2011,[7,8] multilayered MXene-derived materials have become the focus of many research areas due to their desired electrical, thermal, mechanical, chemical as well as biological properties.[9–11] Multilayered MXene (mMXene) is usually generated from the chemical removal of the interlayer of "A" elements (usually from IIIA and IVA groups) in the $M_{n+1}AX_n$ phase, in which X is either carbon and/or nitrogen and M is a kind of transition metal. Due to the aqueous solvents used during the synthesis, the surface of mMXene always has many surface functionalities with the general formula of $M_{n+1}X_nT_x$ (in which T_x is usually a combination of –OH,=O and –F). Previous studies have demonstrated that mMXene products possess superb hydrophilic properties, antibacterial properties, thermal stability, mechanical strength, flexibility, and film-forming capability, which deepen their utilizations in water purification and other applications.[10,12–14] Another interesting characteristic of mMXene is its broad bandwidth of light absorption that can efficiently utilize the solar light.[15,16] Furthermore, some previous elegant works have released that mMXene, like some metallic compounds, displayed efficient absorption capability for near-infrared light as the result of its LSPR effect which is localized

Y. Jin, S. Li
College of Environment and Safety Engineering
Qingdao University of Science and Technology
Qingdao 266042, China
E-mail: leeshaoxiang@qust.edu.cn
Y. Jin, S. Li
Shandong Engineering Research Center for Marine Environment Corrosion and Safety Protection
Qingdao University of Science and Technology
Qingdao 266042, China
Y. Jin, S. Li
Shandong Engineering Technology Research Center for Advanced Coating
Qingdao University of Science and Technology
Qingdao 266042, China
Y. He, H. Wang, J. Liu
College of Materials Science and Engineering
Institute for Graphene Applied Technology Innovation
Qingdao University
Qingdao 266071, China
E-mail: jliu@qdu.edu.cn

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RESEARCH ARTICLE

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Free-Standing and Highly Tough 3D Network of Carbon Nanotubes and MXene Constructed by Facile "Egg-Box" Coordination Mechanism for High-Efficiency Solar Evaporator

*Yang Jin, Xiaole Gong, Yujian He, Hen Wang, Shaoxiang Li, and Jingquan Liu**

Solar steam generation to generate steam through solar light-driven surface evaporation can be an attractive methodology that utilizes green and inexhaustible solar energy to generate water steam and fresh water with superior efficiency. However, some drawbacks of the current photothermal conversion materials such as complicated fabrication process, high cost, and low salt tolerance often heavily restrict their wide applications. Herein, a green and low-cost method is designed and developed for constructing a free-standing, elastic, and highly tough 3D network of carbon nanotubes (CNTs) and MXene through an efficient "egg-box" coordination mechanism in only one step for high-efficiency water evaporation. When the mass ratios of MXene and CNTs are designed at 1:1.5 and cross-linked with sodium alginate and $CaCl_2$, the obtained MCS-3 shows the most excellent light absorption and hydrophilicity, leading to the best evaporation rate of 1.644 kg m^{-2} h^{-1}, and the highest photothermal conversion efficiency of 96%. Moreover, subject to different harsh environments and durability tests, MCS-3 also shows desired structural stability and evaporation performance. As demonstrated by its extraordinary photothermal evaporation properties, MCS-3 can envision a wide range of commercial applications covering wastewater purification, brine seawater, desalination, etc.

1. Introduction

As green source of energy, solar light is inexhaustible and has been utilized by mankind in a rapidly increasing trend.[1] For instance, generation of electricity by sunlight through photovoltaic modules is a promising means to utilizing sunlight. However, the low conversion rate of sunlight which is less than 20% at current stage is still the biggest obstacle for large-scale promotion. One promising method to tackle the bottleneck problem is photothermal conversion of sunlight by high-efficiency solar evaporator, which could achieve high light conversion efficiency up to 100%. Solar evaporators could help release the global water shortage problems which have been aggravated by the rapid increasing demand of fresh water mainly by fast industrial expansion for pushing forward of world economy.[2,3] Though almost 75% of the earth's surface is covered by water, it is mostly the seawater source. Thus, fresh water supply from seawater is the upmost convenient alternative choices since it accounts for about 96.6% of overall water resources. To gain fresh water from seawater, a lot of useful advanced techniques (for instance membrane distillation, reverse osmosis,[4–6] etc.) have been explored. Whereas, these water evaporation techniques with seawater usually have high energy consumption and often cause big environmental pollution, thus they are not applicable for application in laggard and power-insufficient districts.[7–9] Moreover, the conventional equipment, for instance reverse osmosis, often have largely shortened lifetime owning to dramatically increased filtration pressure during the operation of continuous desalination of seawater with high salinity above 7 wt%.[10–12]

Solar steam generation to generating steam through interface evaporation driven by solar energy is a quite hopeful technology that employs abundant green sunlight illumination to evaporate

Y. Jin, S. Li
College of Environment and Safety Engineering
Qingdao University of Science and Technology
Qingdao 266042, China

Y. Jin, S. Li
Shandong Engineering Research Center for Marine Environment Corrosion and Safety Protection
Qingdao University of Science and Technology
Qingdao 266042, China

The ORCID identification number(s) for the author(s) of this article can be found under https://doi.org/10.1002/solr.202300548.

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Y. Jin, S. Li
Shandong Engineering Technology Research Center for Advanced Coating
Qingdao University of Science and Technology
Qingdao 266042, China

X. Gong, Y. He, H. Wang, J. Liu
College of Materials Science and Engineering
Institute for Graphene Applied Technology Innovation
Qingdao University
Qingdao 266071, China
E-mail: jliu@qdu.edu.cn

