Desalination • Volume 568 • 15 December 2023 • Article number 116997

Document type
Article

Source type
Journal

ISSN
00119164

DOI
10.1016/j.desal.2023.116997

Publisher
Elsevier B.V.

CODEN
DSLNA

Original language
English

View less

Femtosecond laser induced porous surface on polymethyl methacrylate for filmwise condensation to improve solar still productivity

Shatar, Nursyahirah Mohd[a]; Sabri, Mohd Faizul Mohd[a, b]; Salleh, Mohd Faiz Mohd[c]; Ani, Mohd Hanafi[d]; Xie, Xitong[e, f]; Weck, Arnaud[e, f]

Save all to author list

[a] Department of Mechanical Engineering, Faculty of Engineering, Universiti Malaya, W.P. Kuala Lumpur, 50603, Malaysia

[b] Centre for Energy Sciences, Universiti Malaya, W.P. Kuala Lumpur, 50603, Malaysia

[c] Department of Electrical Engineering, Faculty of Engineering, Universiti Malaya, W.P. Kuala Lumpur, 50603, Malaysia

[d] Department of Manufacturing and Materials, Kulliyyah of Engineering, International Islamic University Malaysia, W.P. Kuala Lumpur, 50728, Malaysia

[e] Department of Mechanical Engineering, Faculty of Engineering, University of Ottawa, Ottawa, K1N 6N5, ON, Canada

[f] Centre for Research in Photonics, University of Ottawa, Ottawa, K1N 6N5, ON, Canada

Hide additional affiliations

Full text options Export

Abstract

Author keywords

Indexed keywords

Sustainable Development Goals 2023

SciVal Topics

Funding details

Abstract

The decline in freshwater availability has spurred research into employing solar desalination technology. Recent research has concentrated on investigating the use of surface modification to improve the productivity of solar still for desalination. This paper presents the use of femtosecond laser texturing to induce a porous surface on the polymethyl methacrylate (PMMA) cover of a solar still for producing filmwise condensation. Vertical lines 2.5 mm wide were fabricated on the PMMA surface using ultrafast laser texturing, and experiments were conducted using the modified cover on a solar still at a constant basin water temperature. Results show that the static water contact angle measured on the cleaned laser textured surface is hydrophobic. However, the formation of the porous structure leads to a change in wetting state from Cassie-Baxter to Wenzel upon exposure to water vapour. This change in wetting state enables the formation of filmwise condensation under the continuous presence of water vapours. The solar still productivity improves by 15.4 % and 23.1 % using both cleaned and uncleaned laser textured surfaces respectively. The modified surface is stable upon repeated exposure to water vapour, thus proving to be an excellent surface modification method for enhancing PMMA covered solar still performance. © 2023 Elsevier B.V.

Author keywords

Desalination; Femtosecond laser; Laser texturing; PMMA surface modification; Solar still

Indexed keywords

Sustainable Development Goals 2023 New

SciVal Topics

Funding details

References (50)

View in search results format >

All

CSV export | Print | E-mail | Save to PDF

Create bibliography

1 United Nations
The Sustainable Development Goals Report 2022
(2022) . Cited 1123 times.
United Nations Publications

2 Moossa, B., Trivedi, P., Saleem, H., Zaidi, S.J.
Desalination in the GCC countries- a review

(2022) *Journal of Cleaner Production*, 357, art. no. 131717. Cited 30 times.
https://www.journals.elsevier.com/journal-of-cleaner-production
doi: 10.1016/j.jclepro.2022.131717

View at Publisher

3 Mohsenzadeh, M., Aye, L., Christopher, P.
A review on various designs for performance improvement of passive solar stills for remote areas

(2021) *Solar Energy*, 228, pp. 594-611. Cited 21 times.
www.elsevier.com/inca/publications/store/3/2/9/index.htt
doi: 10.1016/j.solener.2021.09.086

View at Publisher

4 Abujazar, M.S.S., Fatihah, S., Rakmi, A.R., Shahrom, M.Z.

The effects of design parameters on productivity performance of a solar still for seawater desalination: A review

(2016) *Desalination*, 385, pp. 178-193. Cited 126 times.
doi: 10.1016/j.desal.2016.02.025

View at Publisher

5 Muthu Manokar, A., Kalidasa Murugavel, K., Esakkimuthu, G.

Different parameters affecting the rate of evaporation and condensation on passive solar still - A review

(2014) *Renewable and Sustainable Energy Reviews*, 38, pp. 309-322. Cited 165 times.
doi: 10.1016/j.rser.2014.05.092

View at Publisher

6 Shoeibi, S., Mirjalily, S.A.A., Kargarsharifabad, H., Khiadani, M., Panchal, H.

A comprehensive review on performance improvement of solar desalination with applications of heat pipes

(2022) *Desalination*, 540, art. no. 115983. Cited 36 times.
https://www.journals.elsevier.com/desalination
doi: 10.1016/j.desal.2022.115983

View at Publisher

7 Chauhan, V.K., Shukla, S.K., Rathore, P.K.S.

A systematic review for performance augmentation of solar still with heat storage materials: A state of art (Open Access)

(2022) *Journal of Energy Storage*, 47, art. no. 103578. Cited 28 times.
http://www.journals.elsevier.com/journal-of-energy-storage/
doi: 10.1016/j.est.2021.103578

View at Publisher

8 Alarifi, I.M., Abo-Khalil, A.G., Al-Qawasmi, A.-R., Alharbi, W., Alobaid, M.

On the effects of nanomaterials on the performance of solar distillation systems-A comprehensive review

(2021) *Solar Energy*, 218, pp. 596-610. Cited 18 times.
www.elsevier.com/inca/publications/store/3/2/9/index.htt
doi: 10.1016/j.solener.2021.03.018

View at Publisher

9 Thakur, A.K., Sathyamurthy, R., Velraj, R., Saidur, R., Lynch, I., Chaturvedi, M., Sharshir, S.W.

Synergetic effect of absorber and condenser nano-coating on evaporation and thermal performance of solar distillation unit for clean water production

(2022) *Solar Energy Materials and Solar Cells*, 240, art. no. 111698. Cited 23 times.
http://www.sciencedirect.com/science/journal/09270248/100
doi: 10.1016/j.solmat.2022.111698

View at Publisher