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Relative Humidity Sensing Using a PMMA Doped Agarose Gel Microfiber

(Article)

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Abstract

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Humidity sensors rely on humidity-induced refractive index change in the sensing material despite the sensor configuration. Polymer-based microwires can absorb water vapor molecules and detect humidity changes without the need of further coating. However, the sensitivity-simplicity trade-off is still a challenge. Sophisticated coating methods, complex resonating structures, and nanostructured films are reported as methods to enhance the device sensitivity. A simple technique, to build a high sensitivity RH sensor based on an agarose-doped Poly Methyl Methacrylate (PMMA) sensor head, is demonstrated. The waist diameter and uniform length of the PMMA doped agarose gel microfiber were measured to be 6 μm and 10 mm, respectively. The sensor can achieve power variation of up to 2.9 μW in a wide relative humidity range (50-80%), and display linear response with a correlation coefficient of 98.29%, sensitivity of 0.421 dB/%RH, and resolution of 0.431%RH. This agarose-based optical sensor provides a beneficial complement to the existing electrical ones, and will promote the employment of agarose in chemical sensing techniques. © 2017 IEEE.

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Author keywords

Agarose humidity sensor microfiber

Indexed keywords

Engineering controlled terms: Atmospheric humidity Chemical sensors Coatings Economic and social effects Esters Refractive index Sensitivity analysis

Compendex keywords Agarose Correlation coefficient Induced refractive index Micro-fiber Relative humidity range Resonating structures Sensor configurations Water vapor molecules

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References (21)

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1 Chen, G.Y., Ding, M., Newson, T.P., Brambilla, G.
A review of microfiber, nanofiber based optical sensors
(2013) *Open Opt. J.*, 7, pp. 32-57. Cited 39 times.

2 Lou, J., Wang, Y., Tong, L.
Microfiber optical sensors: A review
(2014) *Sensors (Switzerland)*, 14 (4), pp. 5823-5844. Cited 43 times.
http://www.mdpi.com/1424-8220/14/4/5823/pdf
doi: 10.3390/s140405823
View at Publisher

3 Brambilla, G., Xu, F., Horak, P., Jung, Y., Koizumi, F., Sessions, N.P., Koukharenko, E., (...), Richardson, D.J.
Optical fiber nanowires and microwires: Fabrication and applications
(2009) *Advances in Optics and Photonics*, 1 (1), pp. 107-161. Cited 152 times.
http://www.opticsinfobase.org/view_article.cfm?
doi: 10.1364/AOP.1.000107
View at Publisher

4 Gu, F., Zhang, L., Yin, X., Tong, L.
Polymer single-nanowire optical sensors
(2008) *Nano Letters*, 8 (9), pp. 2757-2761. Cited 194 times.
doi: 10.1021/nl8012314
View at Publisher

5 Wang, P., Wang, Y., Tong, L.
Functionalized polymer nanofibers: A versatile platform for manipulating light at the nanoscale
(2013) *Light: Science and Applications*, 2 (OCTOBER), art. no. e102. Cited 93 times.
doi: 10.1038/lsa.2013.58
View at Publisher

6 Irawati, N., Suthaskumar, M., John, V., Ali, N.M., Ahmad, H., Harun, S.W.
Fabrication of polymer microfiber by direct drawing
(2015) *Microwave and Optical Technology Letters*, 57 (4), pp. 820-823. Cited 6 times.
http://www.interscience.wiley.com/jpages/0895-2477
doi: 10.1002/mop.28967
View at Publisher

7 Ong, Y.S., Kam, W., Harun, S.W., Zakaria, R.
Fabrication of polymer microfiber through direct drawing and splicing of silica microfiber via vapor spray and flame treatment
(2015) *Applied Optics*, 54 (13), pp. 3863-3867.
http://ao.osa.org/Issue.cfm
doi: 10.1364/AO.54.003863
View at Publisher