





*Journal of Physics: Conference Series* • *Open Access* • Volume 1900, Issue 1 • 16 June 2021 • Article number 012020 • 1st International Conference on Fundamental, Applied Sciences and Technology, ICoFAST 2021 • Virtual, Online • 15 March 2021through 16 March 2021 • Code 169771

**Document type**
Conference Paper • *Bronze Open Access*

**Source type**
Conference Proceedings

**ISSN**
17426588

**DOI**
10.1088/1742-6596/1900/1/012020

**Publisher**
Institute of Physics

**Original language**
English

# Study of Multichannel QCM Prospects in VOC Detection

Aliza Aini Ralib, Md[b]; Bhattacharjee, Soumik[a]; Ralib, Aliza Aini[b]; Vyakaranam, Aparna[a]; Svpk, Satya Devu[a]; Shameem S.S.S.[a]; Sulo, Rafida[a]; Zainuddin, Ahmad Anwar[a]

Save all to author list

[a] Department of Computer Science and Engineering, School of Engineering, Manipal International University, Sembilan, Negeri, Malaysia

[b] Department of Electrical and Computer Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia



Abstract

Reaxys Chemistry database information

Indexed keywords

SciVal Topics

Metrics

Funding details

## Abstract

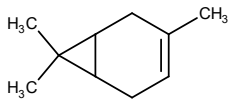
Quartz Crystal Microbalance ( QCM ) is a mass detection sensor capable of measuring mass sensitivity at nanogram levels when based on a thickness shear mode piezoelectric crystal set at high frequencies.

These sensors detect with high accuracy while benefiting from simple geometry, low costs, and ease of fabrication. Researchers prefer piezoelectric crystal sensors to the recent methods of gas chromatography/mass chromatography (GC/MC), high pressure liquid chromatography and nuclear magnetic resonance (NMR), which are time-consuming and not cost-effective. Unlike conventional QCM sensors that are limited to a single-electrode structure - which minimizes their scope of detection - the Multichannel QCM (MQCM) incorporates multiple sensors fabricated on a single crystal wafer. Each sensor is selectively coated with a sensing material that promotes the adsorption of target vapours. One of the widely used application of QCM sensors is in Volatile Organic Compounds ( VOC ) detection . This paper imparts a critical overview of recent publications on the application of MQCMs with various sensing materials. © Published under licence by IOP Publishing Ltd.

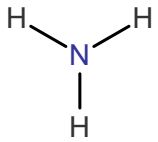
## Reaxys Chemistry database information

Substances

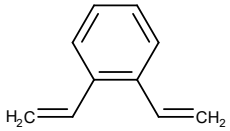
View all substances (16)



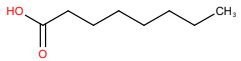

View details




View details




View details




View details

Powered by Reaxys

## Indexed keywords

**Engineering controlled terms**

Cost effectiveness; Crystal structure; Gas chromatography; High pressure liquid chromatography; Nuclear magnetic resonance; Petroleum prospecting; Piezoelectric materials; Piezoelectricity; Single crystals; Volatile organic compounds

**Engineering uncontrolled terms**

High frequency HF; Nuclear magnetic resonance(NMR); Piezoelectric crystal sensors; Piezoelectric crystals; Single crystal wafers; Single electrodes; Thickness shear modes; Volatile organic compound ( VOC )

**Engineering main heading**

Quartz crystal microbalances

SciVal Topics

Metrics

Funding details

| Funding sponsor | Funding number | Acronym |
|---|---|---|
| Department of Computer Science and Engineering | | |
| Manipal International University in Negeri Sembilan, Malaysia | | |

**Funding text**

The work was supported by Department of Computer Science and Engineering, Manipal International University in Negeri Sembilan, Malaysia.

References (43)

View in search results format >

All

Export Print E-mail Save to PDF Create bibliography


1 Wolkoff, P.

Volatile Organic Compounds Sources, Measurements, Emissions, and the Impact on Indoor Air Quality

(1995) *Indoor Air*, 5 (3 S), pp. 5-73. Cited 157 times.
doi: 10.1111/j.1600-0668.1995.tb00017.x

View at Publisher

2 Sumi, L
(2005) *Report on Air Sampling Conducted in Monroe, Conecuh and Escambia Counties*
Alabama (August 1-5) (EARTHWORKS)

3 Lu, H.-H., Rao, Y.K., Wu, T.-Z., Tzeng, Y.-M.

Direct characterization and quantification of volatile organic compounds by piezoelectric module chips sensor

(2009) *Sensors and Actuators, B: Chemical*, 137 (2), pp. 741-746. Cited 61 times.
doi: 10.1016/j.snb.2009.01.060

View at Publisher

4 Liu, K., Zhang, C.

Volatile organic compounds gas sensor based on quartz crystal microbalance for fruit freshness detection: A review

(2021) *Food Chemistry*, 334, art. no. 127615. Cited 29 times.
www.elsevier.com/locate/foodchem
doi: 10.1016/j.foodchem.2020.127615

View at Publisher

5 Feng, S., Farha, F., Li, Q., Wan, Y., Xu, Y., Zhang, T., Ning, H.

Review on smart gas sensing technology (Open Access)

(2019) *Sensors (Switzerland)*, 19 (17), art. no. 3760. Cited 114 times.
https://www.mdpi.com/1424-8220/19/17/3760/pdf
doi: 10.3390/s19173760

View at Publisher

6 Arshak, K., Moore, E., Lyons, G.M., Harris, J., Clifford, S.

A review of gas sensors employed in electronic nose applications

(2004) *Sensor Review*, 24 (2), pp. 181-198. Cited 594 times.
doi: 10.1108/02602280410525977

View at Publisher

7 Ollé, E.P., Farré-Lladós, J., Casals-Terré, J.

Advancements in microfabricated gas sensors and microanalytical tools for the sensitive and selective detection of odors (Open Access)

(2020) *Sensors (Switzerland)*, 20 (19), art. no. 5478, pp. 1-39. Cited 14 times.
https://www.mdpi.com/1424-8220/20/19/5478/pdf
doi: 10.3390/s20195478

View at Publisher

8 McGinn, C.K., Lamport, Z.A., Kymissis, I.

Review of Gravimetric Sensing of Volatile Organic Compounds

(2020) *ACS Sensors*, 5 (6), pp. 1514-1534. Cited 36 times.
http://pubs.acs.org/journal/ascefj
doi: 10.1021/acssensors.0c00333

View at Publisher

9 Noorsal, E, Sidek, O, Mohamad-Saleh, J, Ahmad, M N
(2004) *IEEE Conference on Cybernetics and Intelligent Systems (Singapore,) Detection of volatile organic compounds using quartz crystal microbalance sensor array and artificial neural network IEEE Conference on Cybernetics and Intelligent Systems*, pp. 931-936. Cited 2 times.
2004 2004 IEEE

10 Zainuddin, A.A., Nordin, A.N., Rahim, R.A., Ralib, A.A.M., Khan, S., Guines, C., Chatras, M., (...), Pothier, A.

Verification of quartz crystal microbalance array using vector network analyzer and openQCM (Open Access)

(2018) *Indonesian Journal of Electrical Engineering and Computer Science*, 10 (1), pp. 84-93. Cited 13 times.
http://www.iaescore.com/journals/index.php/IJEECS/article/download/10889/8176
doi: 10.11591/ijeecs.v10.i1.pp84-93

View at Publisher

11 Julian, T., Hidayat, S.N., Rianjanu, A., Dharmawan, A.B., Wasisto, H.S., Triyana, K.

Intelligent Mobile Electronic Nose System Comprising a Hybrid Polymer-Functionalized Quartz Crystal Microbalance Sensor Array (Open Access)

(2020) *ACS Omega*, 5 (45), pp. 29492-29503. Cited 20 times.
pubs.acs.org/journal/acsodf
doi: 10.1021/acsomega.0c04433

View at Publisher

12 Sankaranarayanan, S K R S, Singh, R, Bhethanabotla, V
(2010) *IEEE Sensors 2010 Ninth IEEE Sensors Conference (SENSORS 2010) (Kona, HI,) Computational design of quartz crystal nanobalance for uniform sensitivity distribution 2010 1883-6 IEEE*

13 Joseph, A, Emadi, A
(2019) *IEEE SENSORS 2019 IEEE SENSORS*, pp. 1-4.
(Montreal, QC, Canada: IEEE) Design and Optimization of a Multichannel Quartz Crystal Microbalance Sensor Array for Multiple Target Gas Detection 2019

14 Sauerbrey, G.

(1959) *Zeitschrift für Physik*, 155 (2), pp. 206-222. Cited 9028 times.
doi: 10.1007/BF01337937

15 Boyadjiev, S I, Rassovska, M M
(2007) *Wo3 Thin Films Deposition On Quartz Crystal Resonators For Applications In Gas Sensors*

16 Chikako Kurosawa, S K
(2004) *Proceedings of the 2004 IEEE International Frequency Control Symposium and Exposition, 2004*, pp. 554-557.
(Montreal, Canada) Computational simulation of vibration displacement on piezoelectric quartz crystal using finite element method IEEE

17 Zainuddin, A A
(2019) *Doctor of Philosophy (Engineering)*
(Malaysia: Kulliyyah of Engineering International Islamic University Malaysia)
Integrated Electrochemical And Mass Biosensor For Early Dengue Detection

18 Rabe, J., Seidemann, V., Buettgenbach, S.
Monolithic Fabrication of Wireless Miniaturized Quartz Crystal Microbalance (QCM-R) Arrays and their Application for Biochemical Sensors

(2003) *Sensors and Materials*, 15 (7), pp. 381-391. Cited 14 times.

19 Jiang, X., Kim, J., Kim, K.
Relaxor-PT single crystal piezoelectric sensors (Open Access)

(2014) *Crystals*, 4 (3), pp. 351-376. Cited 42 times.
http://www.mdpi.com/2073-4352/4/3/351/pdf
doi: 10.3390/cryst4030351

View at Publisher

20 Hu, J., Huang, X.
QCM Mass Sensitivity Analysis Based on Finite Element Method

(2019) *IEEE Transactions on Applied Superconductivity*, 29 (2), art. no. 8576652. Cited 10 times.
doi: 10.1109/TASC.2018.2886811

View at Publisher

21 Ali, S.B., Ghatak, B., Gupta, S.D., Debabhuti, N., Chakraborty, P., Sharma, P., Ghosh, A., (...), Bandyopadhyay, R.

Detection of 3-Carene in mango using a quartz crystal microbalance sensor

(2016) *Sensors and Actuators, B: Chemical*, 230, pp. 791-800. Cited 17 times.
doi: 10.1016/j.snb.2016.03.005

View at Publisher

22 Basu, S., Bhattacharyya, P.

Recent developments on graphene and graphene oxide based solid state gas sensors

(2012) *Sensors and Actuators, B: Chemical*, 173, pp. 1-21. Cited 550 times.
doi: 10.1016/j.snb.2012.07.092

View at Publisher

23 Yang, M., He, J.

Graphene oxide as quartz crystal microbalance sensing layers for detection of formaldehyde

(2016) *Sensors and Actuators, B: Chemical*, 228, pp. 486-490. Cited 56 times.
doi: 10.1016/j.snb.2016.01.046

View at Publisher

24 Wang, L., Gao, J., Xu, J.

QCM formaldehyde sensing materials: Design and sensing mechanism

(2019) *Sensors and Actuators, B: Chemical*, 293, pp. 71-82. Cited 44 times.
https://www.journals.elsevier.com/sensors-and-actuators-b-chemical
doi: 10.1016/j.snb.2019.04.050

View at Publisher

25 Siegal, M.P., Yelton, W.G., Overmyer, D.L., Provencio, P.P.

Nanoporous Carbon Films for Gas Microsensors

(2004) *Langmuir*, 20 (4), pp. 1194-1198. Cited 29 times.
doi: 10.1021/la034460s

View at Publisher

26 Palaniappan, A., Su, X., Tay, F.E.H.

Four-channel QCA using mesoporous silica films for gas sensing applications

(2006) *IEEE Sensors Journal*, 6 (6), pp. 1676-1682. Cited 25 times.
doi: 10.1109/JSEN.2006.884169

View at Publisher

27 Wang, X., Cui, F., Lin, J., Ding, B., Yu, J., Al-Deyab, S.S.

Functionalized nanoporous $TiO_2$ fibers on quartz crystal microbalance platform for formaldehyde sensor

(2012) *Sensors and Actuators, B: Chemical*, 171-172, pp. 658-665. Cited 104 times.
doi: 10.1016/j.snb.2012.05.050

View at Publisher

28 Arshad, S, Salleh, M M, Yahaya, M
Quartz Crystal Microbalance Gas Sensor for Detection of Volatile Organic Compounds using Titanium Dioxide coated with Dye-porphyrin
(2008) *Solid State Sci. Technol*, 16, pp. 75-84. Cited 7 times.

29 Horzum, N., Tascioglu, D., Özbek, C., Okur, S., Demir, M.M.

VOC sensors based on a metal oxide nanofibrous membrane/QCM system prepared by electrospinning
(Open Access)

(2014) *New Journal of Chemistry*, 38 (12), pp. 5761-5768. Cited 40 times.
http://pubs.rsc.org/en/journals/journal/nj
doi: 10.1039/c4nj00884g

View at Publisher

30 Boyadjiev, S.I., Georgieva, V., Stefan, N., Stan, G.E., Mihailescu, N., Visan, A., Mihailescu, I.N., (...), Szilágyi, I.M.

Characterization of PLD grown $WO_3$ thin films for gas sensing (Open Access)

(2017) *Applied Surface Science*, 417, pp. 218-223. Cited 38 times.
http://www.journals.elsevier.com/applied-surface-science/
doi: 10.1016/j.apsusc.2017.03.212

View at Publisher

31 Rianjanu, A., Hasanah, S.A., Nugroho, D.B., Kusumaatmaja, A., Roto, R., Triyana, K.

Polyvinyl acetate film-based quartz crystal microbalance for the detection of benzene, toluene, and xylene vapors in air (Open Access)

(2019) *Chemosensors*, 7 (2), art. no. 20. Cited 26 times.
https://res.mdpi.com/chemosensors/chemosensors-07-00020/article_deploy/chemosensors-07-00020-v2.pdf?filename=&attachment=1
doi: 10.3390/chemosensors7020020

View at Publisher

32 Hidayat, S.N., Julian, T., Rianjanu, A., Kusumaatmadja, A., Triyana, K., Roto

Quartz crystal microbalance coated by PAN nanofibers and PEDOT: PSS for humidity sensor

(2017) *Proceedings - 2017 International Seminar on Sensor, Instrumentation, Measurement and Metrology: Innovation for the Advancement and Competitiveness of the Nation, ISSIMM 2017*, 2017-January, pp. 119-123. Cited 15 times.
ISBN: 978-153860745-9
doi: 10.1109/ISSIMM.2017.8124274

View at Publisher

33 Triyana, K., Sembiring, A., Rianjanu, A., Hidayat, S.N., Riowirawan, R., Julian, T., Kusumaatmaja, A., (...), Roto, R.

Chitosan-based quartz crystal microbalance for alcohol sensing (Open Access)

(2018) *Electronics (Switzerland)*, 7 (9), art. no. 181. Cited 30 times.
http://www.mdpi.com/2079-9292/7/9/181/pdf
doi: 10.3390/electronics7090181

View at Publisher

34 Ghatak, B., Ali, S.B., Prasad, A., Ghosh, A., Sharma, P., Tudu, B., Pramanik, P., (...), Bandyopadhyay, R.

Application of Polymethacrylic Acid Imprinted Quartz Crystal Microbalance Sensor for Detection of 3-Carene in Mango

(2018) *IEEE Sensors Journal*, 18 (7), pp. 2697-2704. Cited 16 times.
http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7361
doi: 10.1109/JSEN.2018.2794607

View at Publisher

35 Wu, T.-Z., Lo, Y.-R., Chan, E.-C.

Exploring the recognized bio-mimicry materials for gas sensing

(2001) *Biosensors and Bioelectronics*, 16 (9-12), pp. 945-953. Cited 34 times.
doi: 10.1016/S0956-5663(01)00215-9

View at Publisher

36 Marsh, D., Bartucci, R., Sportelli, L.

Lipid membranes with grafted polymers: Physicochemical aspects (Open Access)

(2003) *Biochimica et Biophysica Acta - Biomembranes*, 1615 (1-2), pp. 33-59. Cited 186 times.
www.elsevier.com/locate/bbamem
doi: 10.1016/S0005-2736(03)00197-4

View at Publisher

37 Wyszynski, B., Somboon, P., Nakamoto, T.

Mixed self-assembled lipopolymers with spacer lipids enhancing sensitivity of lipid-derivative QCMs for odor sensors

(2008) *Sensors and Actuators, B: Chemical*, 134 (1), pp. 72-78. Cited 9 times.
doi: 10.1016/j.snb.2008.04.015

View at Publisher

38 Guterman, R., Ambrogi, M., Yuan, J.

Harnessing Poly(ionic liquid)s for Sensing Applications
(Open Access)

(2016) *Macromolecular rapid communications*, 37 (14), pp. 1106-1115. Cited 24 times.
http://www3.interscience.wiley.com/journal/117932056/grouphome
doi: 10.1002/marc.201600172

View at Publisher

39 Zeng, X., Jin, X., Huang, Y., Mason, A.

Multichannel monolithic quartz crystal microbalance gas sensor array

(2009) *Analytical Chemistry*, 81 (2), pp. 595-603. Cited 61 times.
http://pubs.acs.org/doi/pdfplus/10.1021/ac8018697
doi: 10.1021/ac8018697

View at Publisher

40 Jha, S.K., Liu, C., Hayashi, K.

Molecular imprinted polyacrylic acids based QCM sensor array for recognition of organic acids in body odor

(2014) *Sensors and Actuators, B: Chemical*, 204, pp. 74-87. Cited 50 times.
doi: 10.1016/j.snb.2014.07.098

View at Publisher

41 Banerjee, M.B., Chowdhury, S.R., Roy, R.B., Tudu, B., Ghosh, M., Pramanik, P., Bandyopadhyay, R.

Development of a Low-Cost Portable Gas Sensing System Based on Molecularly Imprinted Quartz Crystal Microbalance Sensor for Detection of Eugenol in Clove Oil

(2021) *IEEE Transactions on Instrumentation and Measurement*, 70, art. no. 9181614. Cited 9 times.
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=19
doi: 10.1109/TIM.2020.3020676

View at Publisher

42 Ko, W., Jung, N., Lee, M., Yun, M., Jeon, S.

Electronic nose based on multipatterns of zno nanorods on a quartz resonator with remote electrodes

(2013) *ACS Nano*, 7 (8), pp. 6685-6690. Cited 36 times.
doi: 10.1021/nn4027245

View at Publisher

43 Penza, M., Cassano, G., Aversa, P., Antolini, F., Cusano, A., Consales, M., Giordano, M., (...), Nicolais, L.

Carbon nanotubes-coated multi-transducing sensors for VOCs detection

(2005) *Sensors and Actuators, B: Chemical*, 111-112 (SUPPL.), pp. 171-180. Cited 65 times.
doi: 10.1016/j.snb.2005.06.055

View at Publisher

Zainuddin, A.A.; Department of Computer Science and Engineering, School of Engineering, Manipal International University, Sembilan, Negeri, Malaysia; email:ahmad.anwar@miu.edu.my


Back to results | 1 of 1

Top of page

## About Scopus

What is Scopus

Content coverage

Scopus blog

Scopus API

Privacy matters

## Language

日本語版を表示する

查看简体中文版本

查看繁體中文版本

Просмотр версии на русском языке

## Customer Service

Help

Tutorials

Contact us

ELSEVIER