Keywords: nanostructured silicon, photovoltaic energy, current-voltage characteristics.

References

[1] A. A. Ischenko, G. V. Fetisov, and L. A. Aslalnov, *Nanosilicon: Properties, Synthesis, Applications, Methods of Analysis and Control*. CRC Press, USA, 2014.

[2] D. Thomson, A. Zilkie, J.E. Bowers, et al., «Roadmap on silicon photonics», *J. Optics,* 18, pp. 07300, 2016.

[3] S. Wipperman, Y. He, M. Voros, and G. Galli, «Novel silicon phases and nanostructures for solar energy conversion», *Appl. Phys. Rev.,* 3, pp. 040807, 2016.

[4] L.A. Osminkina, V. Sivakov, G. A. Mysov, et al., «Photoluminescent biocompatible silicon nanoparticles for cancer theranostic applications», *J. Biophotonics,* 5, pp. 529-535, 2012.

[5] S. Dhanekar and S. Jain, «Porous silicon biosensor: Current status», *Biosens. & Bioelectr*., 41, pp. 54-64, 2013.

[6] C. Abreu, P. Mendes, « Wireless sensor networks for biomedical applications», *in: Proceedings of the 2013 IEEE 3rd Portuguese Meeting in Bioengineering*, pp. 1–4, 2013.

[7] M. reza Akhondi, A.Talevski, S. Carlsen, S. Petersen, «Applications of wireless sensor networks in the oil, gas and resources industries», in *Proceedings of the 24th IEEE Int. Conference on Advanced Information Networking and Applications*, pp. 941–948, 2010.

[8] M. Z. A. Bhuiyan, G. Wang, J. Wu, J. Cao, X. Liu, T. Wang, «Dependable structural health monitoring using wireless sensor networks», *IeeeEEE Trans. Depend. Secur. Comput.*, 14, pp. 363–376, 2012.

[9] S. D. T. Kelly, N. K. Suryadevara, S. C. Mukhopadhyay, «Towards the implementation of IoT for environmental condition monitoring in homes», *IEEE Sens. J*., 13 ph. 3846–3853, 2013.

[10] F. T. Jaigirdar, M. M. Islam, S. R. Huq, «An efficient and cost effective maximum clique analysis based approximation in military application of wireless sensor network», in *Proceedings of the 14th International Conference on Computer and Information Technology, ICCIT*, pp. 85–90, 2011.

[11] M. P. Durisic, Z. Tafa, G. Dimic, V. Milutinovic, «A survey of military applications of wireless sensor networks», in *Proceedings of the Mediterranean Conference on Embedded Computing*, *Bar, Montenegro*, pp. 196-199, 2012.

[12] J. Sarwar, G. Georgakis, K. Kouloulias, K.E. Kakosimos, «Experimental and numerical investigation of the aperture size effect on the efficient solar energy harvesting for solar thermochemical applications», *Energy Convers. Manag*., 92, pp. 331–341, 2015.

[13] S. Y. Chang, P. Cheng, G. Li, Y. Yang, «Transparent polymer photovoltaics for solar energy harvesting and beyond», *Joule*, 2, pp. 1039–1054, 2018.

УДК 532.61

DEVICE FOR RESEARCH OF SURFACE PROPERTIES OF LIQUIDS BY GAS JET METHOD

Bodnar R. T.
Ivano-Frankivsk National Technical University of Oil and Gas, Ivano-Frankivsk, Ukraine

Many technological processes of ore flotation, oil and gas production, well drilling, as well as in the production of man-made fibers, rubber, plastics, in the pulp and paper and other industries use solutions of surfactants. For the purpose of optimal carrying out of such processes constant or periodic monitoring of surface tension

(ST) of technological liquids for an estimation of contents in surfactant liquid is carried out [1].

The principle of operation of many modern devices for determining the ST of liquids is based on such methods as, lying drop, separation of the ring, the maximum pressure in the bubble, etc. [2]. Each of these methods has a specific application depending on the type of fluid and the conditions for measuring the ST, but all these methods have one common drawback - the contact of the fluid with the instrument acting on it. Such an instrument is a platinum ring in the ring separation method, a calibrated capillary in the maximum bubble pressure method or a Wilhelmi plate method, etc.

The presence of any impact instrument requires its thorough cleaning after each measurement, which reduces the productivity of the liquid ST determination process and makes it impossible to conduct continuous monitoring of the ST. Failure to observe the purity of the impact instrument will lead to significant errors in the measurement results.

In all methods of determining the ST of liquids, regardless of which mediator parameter is used - the force of separation of the ring or the maximum pressure in the bubble, etc. - in the theoretical justification for determining the ST in each method there are geometric parameters of the capillary surface (meniscus) Laplace [2]:

$$P = \sigma \left(\frac{1}{R_1} - \frac{1}{R_2} \right), \quad (1)$$

where σ is the surface tension of the fluid; P - capillary pressure; R_1 and R_2 are the radius of curvature of the capillary surface in mutually perpendicular sections.

To determine the ST, equation (1) is implemented in particular in the method of maximum bubble pressure. But the capillary surface will be formed not only inside the bubble, but also when the gas jet acts on the free surface of the liquid. And the geometric parameters of the meniscus will be related to the surface tension of the fluid. To establish such a connection, a device was developed, the block diagram of which is shown in Fig.1

The operation of the device is as follows. Pressurized air from the microcompressor 2 enters the stabilizer 3 and the pressure regulator 4, to which is connected the pressure meter 6 and the nozzle 13, from which air is blown to the surface of the liquid. Under the action of air pressure on the surface of the liquid creates a meniscus, the shape of which is perceived by a digital microscope 8. Illumination of the contour of the meniscus is created by illuminator 1. Information from the digital microscope enters the personal computer 11, which will process this information.

Information processing is to determine the contour line and cross-sectional area of the meniscus figure. Further research will be to establish an algorithm for information processing and methods of measurement.

The use of such a device will allow the use of process fluids for continuous monitoring of surface tension (ST) or to assess the negative impact of ST on the environment.

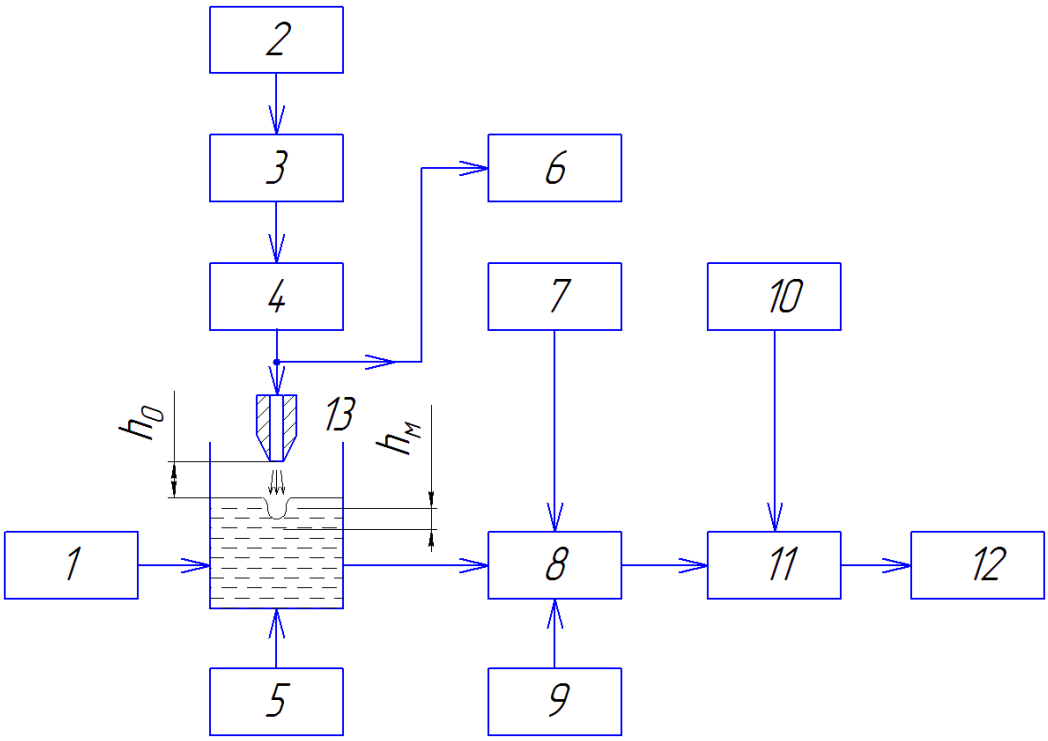

Fig. 1. Block diagram of devices: 1 – illuminator; 2 – microcompressor; 3 – pressure stabilizer; 4 – pressure regulator; 5 – lifting mechanism; 6 – pressure meter; 7 – image sharpness control; 8 – digital microscope; 9 – movement mechanism; 10 – keyboard; 11 – personal computer; 12 – monitor; 13 – nozzle

Keywords: surface tension, measurement.

References

[1] В. Д. Михайлюк, М. І. Рудий, Р. Т. Боднар та ін., "Використання поверхнево–активних речовин в процесах нафтовидобутку на родовищах ВАТ "Укрнафта", *Монографія, Івано–Франківськ: ПП "Галицька друкарня ПЛЮС"*, 2009. – 400 с.

[2] А. И. Русанов, В. А. Прохоров, *Межфазная тензометрия. Монографія. СПб.: Химия,* 1994.

УДК 539.394

A NEW METHOD FOR ESTIMATING THE TOTAL DUST CONTENT OF ATMOSPHERIC AIR WITH PM2.5 AND PM10 BASED ON THE FUZZY MODEL

Bozhko K. M, Morozova S. V., Bochkova O. P.
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Kyiv, Ukraine
E-mail: bozhkonew@ukr.net

The currently known method of air quality assessment AQI (Air Quality Index) based on measuring the concentration of PM2.5 particles is the main one for air monitoring stations [1]. The method of estimating AQI is analogous to the method