УДК 681.1218(075.8)
ББК 31.32.5я73
П52

THE SPECIFIC SURFACE OF THE SOLID PHASE AND THE DEVELOPMENT OF MEASURING DEVICES FOR ITS RAPID CONTROL

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The kinetics of the process and the quality of the product obtained in heterogeneous processes are largely dependent on the specific surface of the solid phase and sorbents. The specific surface is an averaged characteristic of sizes of internal cavities (channels, pores) of the porous body or fragmented particles of dispersed system phase. Currently, this parameter is only monitored at the end of the process, when the correction is delayed.

The informative parameter of the specific surface (Sy) is used in the production of alumina as raw material for aluminum, gold recovery from solutions and slurries, cement production, catalysts and others, because it allows to control the speed of heterogeneous processes and to manage the quality of the finished product.

Numerous methods that differ from each other by physical essence, sensitivity, measurement range, structural design, analysis duration have been developed to determine the specific surface of solids. Adsorptive measuring procedure of bulk materials specific surface which allows to measure the complete surface of particles with pores and cracks on the basis of gaseous low-temperature physical adsorption of nitrogen or argon (BET method) is widely spread.

The disadvantage of the methods used at the moment is low speed of adsorption process and, consequently, low productivity of the plant implementing the method as well as high cost of the analysis, need for increased safety measures when using the BET method, and the fact that the method is not automated.

Currently, the industry is searching for a measuring device having such parameters as: low cost of the analysis, high speed of the process, automated device, simplicity in use.

In ISTU (National research Irkutsk State technical university) a measuring device for rapid control of this parameter has been designed in the process, porosity and specific surface of activated carbons used as a sorbent when extracting gold from solutions and slurries has been studied.

Process of measuring and calculating of the specific surface of the proposed analyzer is automated. Moreover, the operator has full control of the process by a computer. Block scheme SU of the specific surface analyzer (sorption meter) with inter-device microcontroller.

Measurement process of the specific surface is controlled by the inter-device microcontroller. The specific surface of the sample is calculated by the same microcontroller according to current signal of the thermal conductivity detector imbalance. Programming of the the controller responsible for temperature regulation is in CodeSys medium in CFC language.

Control of the process of the specific surface determining is done by connecting the device to a PC. The user interface is made in SCADA- TraceMode 6. Values of the detector and adsorber temperature, control of air output volume, analysis time, adsorption trend which allows to manage the process in automatic mode and to present measuring processes graphically in real time are entered in this visualization system. The created interface allows to manage the process (air supply, heating) directly with the computer monitor.

Structurally, all thermostats, panel of gases preparation and dryer for samples are made in the form of a single fiberglass sensor unit. Asbestos board is used as a heat insulator. Temperature in the Katharometer thermostats and adsorber is supported by regulators.

The economic effect of the development is achieved by accelerating the analysis and getting opportunity in pace with the process to make a correction signal APCS. Besides the rejection of glass fittings, pressure vessels, using of liquefied gas as a refrigerant improves safety in operation. Low cost of the analysis is provided by reducing the measurement time by 3-4 times, while ensuring basic relative error which does not exceed ± 5% (Table 1).

Table 1

Analyzer optimization parameters of the specific surface using the method of VMTD and BET

No.	Parameter name	VMTD	BET
1	Full time of analysis	15	90
2	Automatic control of temperature	+	-
3	Value of the device, thousands $	5...10	25...35
4	Relative error, (%)	±5	±5

The grading will be based on state standard samples of the specific surface. The calibration interval is 1 year.

1.Patent RU 2248553, G01N 15/08, published on 20.03.2005.
2.Patent RU 2376582, G01N15 / 08, published on 20.12.2009.

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This work was done by virtue of financial support of Project No.02.G25.31.0075 under of the Government of the Russian Federation No. 218 of April 9, 2010.