A. Z. ISSAGULOV, V. YU. KULIKOV, Y. P. CHSHERBAKOVA, E. M. AZBANBAYEV, SV. S. KVON
ISSN 0543-5846
METABK 55(2) 203-205 (2016)
UDC – UDK 525.5.517:622.784:620.193.002.61=111

INVESTIGATION OF SEDIMENTATION ANALYSIS OF SUSPENSIONS WITH 20 % OF THE CONTENT HALLOYSITE CLAY

Received – Primljeno: 2015-03-26
Accepted – Prihvaćeno: 2015-10-15
Preliminary Note – Prethodno priopćenje

The paper describes the sedimentation analysis of the suspension. This allows us to get complete information about the particle size distribution used for protection against corrosion of pump parts covered with halloysite, thus giving a complete picture of its properties. Using this method is important in the calculation of concentrations when applied to anticorrosive coating. That in the future will increase the service life of parts on which corrosion liquid with halloysite was applied.

Key words: sedimentation analysis, suspension, halloysite, corrosion, properties

INTRODUCTION

Currently, the most urgent problems in the field of physical materials science of nanostructured metallic materials is to study the stability of the structure during the impact of external factors, especially corrosive environments. Highly promising way to increase the corrosion resistance of metallic materials is to apply to their surface corrosion hardening coatings. However, information on the corrosion resistance of coated nanostructured materials almost no literature.

The aim is to study the corrosion resistance of the samples of steel, cast iron in the initial state, after applying anticorrosive material anticorrosive material with halloysite particles, uncoated and testing them in aggressive environments [1].

EXPERIMENTAL PART

Equipment and tools

There was conducted the sedimentation analysis of suspensions, which included 20% content of halloysite clay.

The sedimentation analysis is used to determine the size of particles in systems of relatively low degree of dispersion (suspension, emulsion).

The aim is to provide an analysis of variance of the distribution curves, the analysis of which allows you to set what the relative content of particles in the specified range of radii, or, in other words, what is the fractional composition of the system.

The main technique involves the method based on the different rates of deposition (sedimentation) of particles of various sizes in the pre-uniformly stirred suspension (Stokes' law) and changes in solution turbidity during the deposition, recorded in direct transmitted light (photometric method Bouguer-Lambert-Berra).

The study was conducted on photosedimentometer FSH-6K. Photosedimentometer FSH-6K - classic uses the most direct of the known automated methods for measuring particle size distribution. Needs to be calibrated to an external reference and administration (direct or indirect) randomly selected (not a direct consequence of the theory used in them) coefficients and amendments.

Materials and methods

The mechanical moving parts of the device FSH-6K is minimized (mixer homogenizer), runs reliably and performs all necessary functions for measurement, does not demand additional tools. Using 3 measuring channels (3 slotted aperture in height of the cell) can significantly reduce the systematic and random errors and thus improve the accuracy of the instrument, as well as shorten the time of measurement Figure 1.

FSH device cuvette 6 can measure particle size distribution of the powders not only in water, but other solvents, including organic - soluble material for; Consumption of such fluids is small, they can be used repeatedly.

Figure 1 General view of photosedimentometer FSH-6K

A. Z. Isagulov, V. Yu. Kulikov, Y. P. Chsherbakova, E. M. Azbanbayev, Sv. S. Kvon, Karaganda State Technical University, Karaganda, Kazakhstan

Distilled water was used as disperse medium, chemical and physical characteristics of which are given below in Table 1. The dispersion liquid should form a stable suspension with the powder, the particles are well wetted and be chemically inert thereto; density and viscosity should be such that laminar flow conditions are provided for the coarse particle size, and the duration of the entire analysis is not more than 6 hours.

Table 1 **Chemical and physical parameters of distilled water**

Parameter	Standard
The mass concentration of the residue after evaporation / mg / dm^3, max	5
The mass concentration of ammonia and ammonium salts (NH_4) / mg / dm^3, max	0,02
The mass concentration of nitrates (CO_3) / mg / dm^3, max	0,2
The mass concentration of sulfate (SO_4) / mg / dm^3, max	0,5
The mass concentration of chloride (Cl) / mg / dm^3, max	0,02
The mass concentration of aluminum (Al) / mg / dm^3, max	0,05
Mass concentration of iron (Fe) / mg / dm^3, max	0,05
The mass concentration of calcium (Ca), mg / dm^3, max	0,8
Water pH	5,4 - 6,6

Selected as the disperse medium liquid is poured into the cuvette with the plunger so that there were no air bubbles formed and placed into the unit and calibrate. Then proceed to the preparation of suspensions we take halloysite as a powder and sieved to remove particles №004 larger than 40 micrometers (Figure 2).

RESULTS AND DISCUSSION

The powder was filled in a porcelain mortar and was added thereto a small amount of glass dispersion medium (no more than 5 ml). Thus received paste was triturated for 2 - 3 minutes and then was added another small amount of the dispersion medium and gently added the contents of the mortar into a cell with a dispersion medium (distilled water), put it in the pack and pushed "MEASUREMENT START".

Stirred thoroughly in the liquid sample powder is deposited, separated by the size of its constituent particles according to Stokes' law (the settling velocity is proportional to the square of their size).

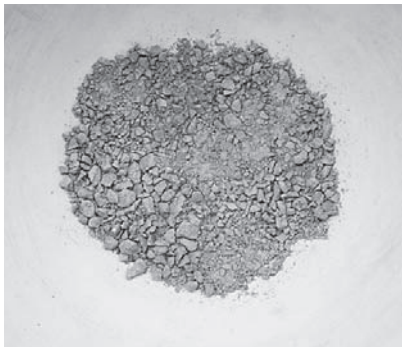

Figure 2 Preparation of halloysite powder

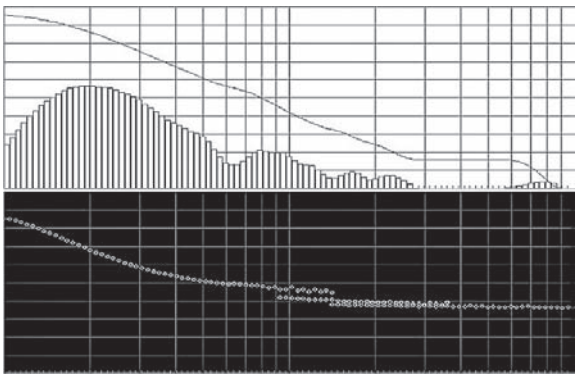

Figure 3 Construction of the graph

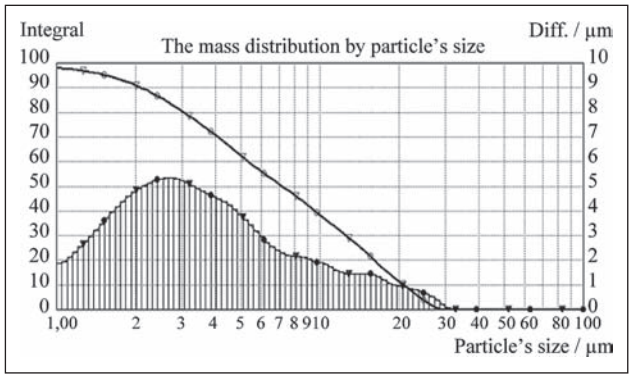

Figure 4 Result of I measurement of suspension

The program of the apparatus not only displays on the computer screen the progress of the measurement process (light intensity curve), but also processes the data and plotting the preliminary results (particle distribution) directly during measurement (Figure 3) processing time is 14 - 16 minutes.

After the construction of the graph is about to end, push the tab "Results", there will be seen a measurement (I) graph - results of the particle mass distribution by size (Figure 4).

For distinguishing between a large number of curves on the same graph they are marked with different color markers and their decoding, as is customary in the construction of graphs (e.g. EXCEL) provide space for captions.

Similarly conduct additional 2 measurements (Figure 5) are conducted, while observing that with repeated

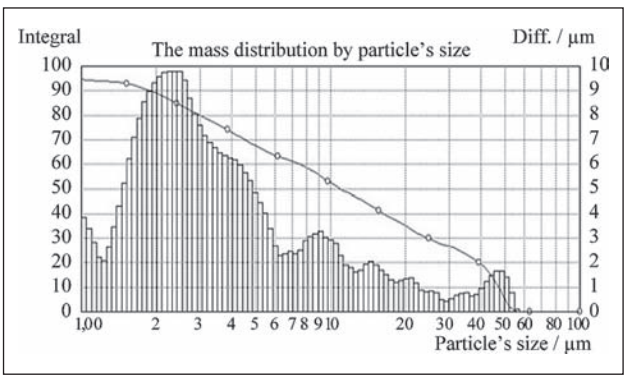

Figure 5 The graph of III measurement

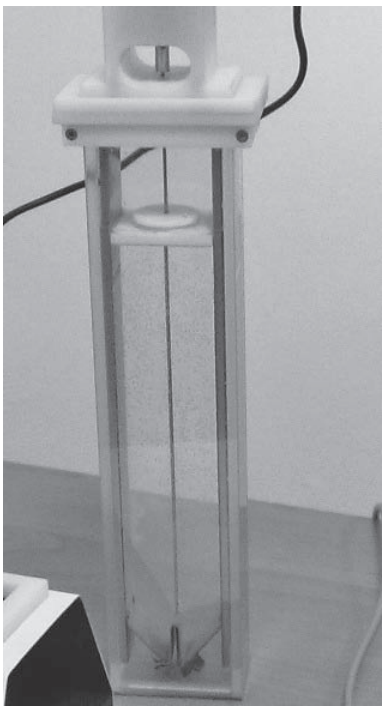

Figure 6 General view of the suspension after three measurements

measurement dispersed structure of the suspension becomes clearer gradually Figure 6.

Thereby this makes it possible to conclude that the intensity of suspension particles deposition, making it more transparent provides the most information on the granulometric dimensions of halloysite particles.

The average value of output Figure 7 between the three measurements can also be attributed to the advantage of photosedimentometer FSH-6K, so it is possible to see the intensity of the particle distribution by granulometric size.

All the results of all measurements are stored in specialized DAT files.

Performed sedimentation analysis of the suspension gives us the full information about the particle size distribution used for protection against corrosion of pump parts, covered with anti-corrosive liquid with halloysite, thus giving a complete picture of its properties, which is not less important in the calculation of the concentration with anticorrosive coating.

Using photosedimentometer FSH-6K during research makes it possible to real-time display on the computer display of the measured parameters, built-board ADC (digital input) makes the instrument completely autonomous, used 3 - channel measurement (3 slotted aperture in height of the cell), can significantly reduce systematic and random errors and thus improve the accuracy of unit and reduce the measurement time.

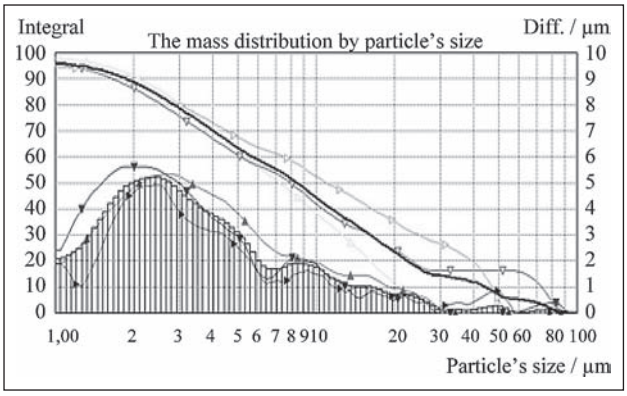

Figure 7 Mean value between the three measurements

CONCLUSIONS

The performed suspension sedimentation analysis gives complete information about the particle size distribution used for protection against corrosion of pump parts, covered with anti-corrosive liquid with halloysite, thus giving a complete picture of its properties, which is important in the calculation of the concentration during application of anticorrosive coating.

Using the photosedimentometer FSH-6K in the research makes it possible to real-time display on the computer display of the measured parameters, built-board ADC (digital input) makes the instrument completely autonomous, used 3 - channel measurement (3 slotted aperture in height of the cell), can significantly reduce systematic and random errors and thus improve the accuracy of unit and reduce the measurement time.

Acknowledgement

The research was carried out in the framework of the International Materials Science Center.

REFERENCES

[1] Issagulov A.Z., Sharaya O.A., Kulikov V.Yu., Chsherbakova Y.P. Improvement of corrosion resistance of metals by the use of corrosion-resistant coatings based on halloysite. K .: Proceedings of the University, 3 (2013), 20-22.

[2] Lvov, Y; Schukin, D., Moehwald, H.: Price, R. "Clay Nanotubes for Controlled Release of Protective Agents," ACSNano, 2 (2008), 814-820.

[3] Lvov, Y., Price, R.; Gaber, B., Ichinose, I. Thin Film Nanofabrication via Layer-by-Layer Adsorption of Tubule Halloysite and Polycations. Colloids and Surfaces: Engineering 198 (2002), 375-382.

[4] Fu, Y.; Zhang, L. Deposition of Ni Nanoparticles and Wires on a Tubular Halloysite Template: Novel Ceramic Microstructure. J. Solid State Chemistry 178 (2005), 3595-3600.

Note: The responsible translator for English language is N.M. Drag, Karaganda, Kazakhstan