

Fiber optical system for on-line monitoring of industrial processes

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Abstract

The method of IR-Fourier spectroscopy – a rapid method for qualitative and quantitative analysis of substances. The study of water and aqueous solutions of spectral methods linked with the problem of large water absorption in the infrared region of the spectrum. Development of methods for measurement of IR spectra of aqueous solutions is an important task, both for fundamental and for applied science.

The article presents the authors' work on the development of fiber-optic probes for IR spectroscopy mid-infrared (2-25 microns) of polycrystalline fibers based on the system AgBr – TII. Fiber-optic probes allow you to apply the methods of IR spectroscopy for qualitative and quantitative analysis of chemical composition of water and aqueous solutions in on-line mode. The suitability of using fiber-optic probes for the analysis of aqueous solutions by IR-Fourier spectroscopy is demonstrated on the example of the study of the spectra of aqueous solutions of methanol and electrolytes gilding.

As a result of the experiments shows the possibility of measuring the concentration of methanol in aqueous solutions with a precision of 10^{-3} mol/liter in real-time. The authors compared the sensitivity of standard methods of measurement – ATR coupler and fiber optic probes. Shown increased sensitivity of fiber optic probes with sensing elements of complex shape, which occurs due to the increase of contact points of the analytical signal and the test medium. As a result of measuring the optical characteristics of electrolytes of gold plating demonstrated the ability to capture the displacement of the absorption bands of the CN bonds in the release of gold ions from a complex potassium dicyanoaurate, with fiber optic probe connected to the spectrometer. The use of the proposed spectral methods for the analysis of water and aqueous solutions in scientific laboratories and industrial production will greatly expand the possibilities of application of methods of IR-Fourier spectroscopy for solving problems of rapid analysis of substances. The use of remote monitoring systems of technological processes based on IR fibers will reduce the time and labor for analysis of production samples during the production process, automate production lines, enhance product quality, improve working conditions.