2016

ATHB300 Series

Multi-parameters Water Quality Analyzer

Spectra Measurement Solution

OPTOSKY PHOTONICS INC.

1. Solution Introduction:

Modern water quality monitoring techniques based on absorbance spectrum analysis, include two categories of on-line and in-situ.

1） On-line water quality monitoring includes a phase of sampling, and absorbance spectrum analysis can qualitatively & quantitatively analyze ingredients and contents of a material in water sample, and also analyze physical properties such as chrominance, turbidity etc. Water sample to be detected requires online pre-treatment, such as online colorization, concentration, extraction and catalysis, etc.

2） In-situ water quality monitoring can fasten spectrometer in the district of river or lake, and flowing water can automatically enter flow cell of spectrometer, then absorbance spectrum analysis can realize in-situ monitoring.

2. Absorbance measurement condition

2.1 Incident wavelength

It shall choose maximum absorption wavelength for incident light, and called “principle of maximum absorption”, so that detect result can be with higher sensitivity. Select such wavelength to perform analysis, it not only has higher sensitivity, but also reduce or remove deviation of Lambert-Beer Law caused by non-monochromatic light. However, if the maximum absorption wavelength is disturbed by other light absorbing substance, it shall base on wavelength of incident light.

Dimethylglyoxime photometry is applied to measure steel nickel, maximum absorption wavelength of nickel dimethylglyoxime is 470nm, Fe is masked with sodium tartrate also absorb in 470nm, so that measurement of nickel can be disturbed. If the wavelength of 520nm selected to measure, sensitivity is reduced but Ferric Tartrate avoid disturbing nickel.

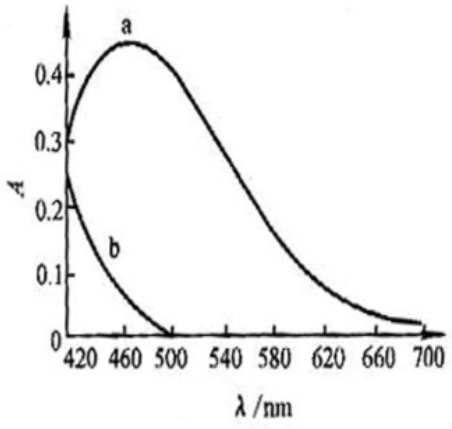


Fig 1 a. Nickel Dimethylglyoxime b. Ferric Tartrate

2.2 Reference Solution

Principle：Absorbance measured can reflect concentration of material to be detect.

When measure absorbance, reference solution used to calibrate at zero point, result in removing deviation due to cell wall or reagent reflect and absorb incident light.

1）MRn is colorful→pure reagent is referenced. M, R is colorless, distilled water is referenced in water system.

2）chromogenic agent R or other reagent has absorption→reagent blank is referenced(that is no test sample is added into solution)

3）test sample other components N absorb，but has no reaction with R

A：When R absorb——Reagent is referenced

That is N, MRn absorbs——include N，exclude MRn is referenced，that reagent is referenced

B：All of R, N, MRn absorb——add masking agent in test solution, components detected M^{n+} is masked, and add R, is referenced.

In other words：M^{n+} is masked，R & N is referenced.

2.3 Absorbance reading range

Reading of different absorbance range cause measure deviation, test sample fit absorbance law is supposed as shown below:

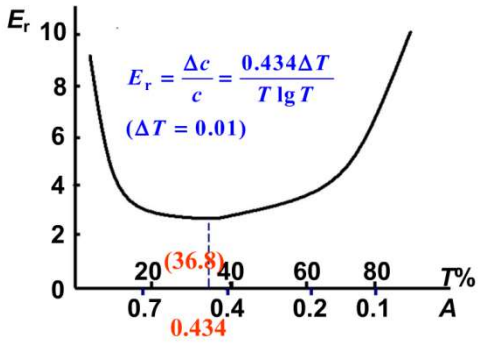


Fig 2 concentration measurement relative deviation and T/A relationship

In actual measuring work, T shall be controlled between 10~70%, A between 0.15~1.0(adjust c,b,λ).

2.4 Standard Curve

Light absorption law: absorbance is in proportion to concentration of the material absorbed, as a basis of photometry to perform quantitativeness, standard curve is based on it.

Specific method: In the condition of selective experiment, separately measure absorbance of a series of various solution concentration. Ingredient contents of standard solution is set horizontal axis, absorbance is set vertical axis, a straight line starts from base point called standard curve. Absorbance of solution detected can be corresponding to contents of material detected.

If sometimes standard curve does not go through original point, reference solution could be caused by unsuitable reference solution, uneven cell wall thickness, bias cell position, and transmittance surface is not clean. If colorful complex is of high degree of dissociation, especially other complex reagent is available, then it usually make incomplete coloration of material detected in the low concentration condition.

3. Detect range

This experiment platform can detect heavy metal, ammonia-nitrogen, nitrate, total nitrogen, chloride ion, phosphate, total phosphorous, TOC,COD, and more key parameters of water quality, and handle problems of water quality analysis.

4. Structure of Monitoring System

Measure monitoring system is made up of four parts, flow route system, optical system, online sample chemical pretreatment system, monitoring system. Miniature spectrometer is core among optical system, including light source, focusing and collimating, multi-function detect chamber, and miniature spectrometer. Light source generate light is collimating, then incident light enter multi-function sample detect chamber, penetrated light go throughsample chamber focus on fiber probe via mirror, silica fiber coupled enter microspectrometer, system structure as shown in Fig 3, this optical system can realize continuous spectra of 190-1000nm measurement with high accuracy.

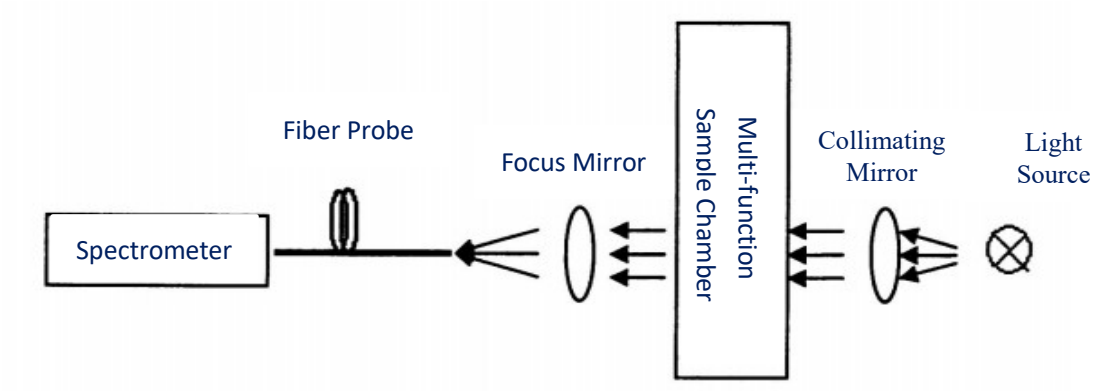
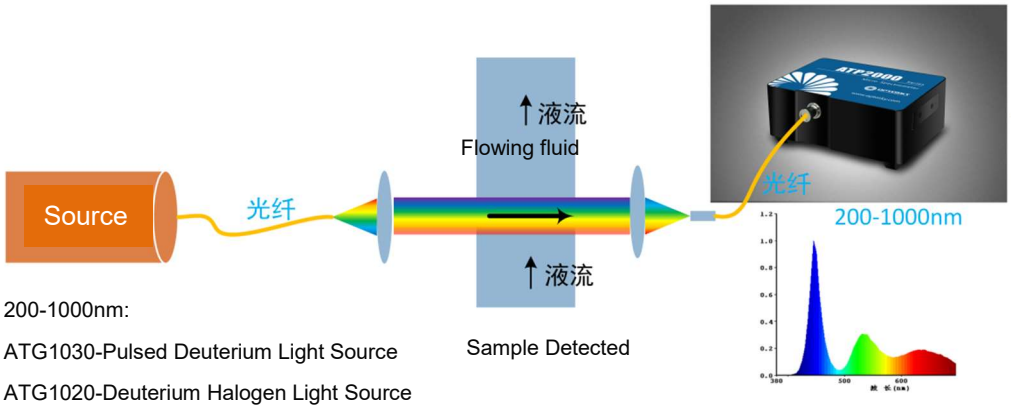


Fig 3 Optical System Graph

5.Solution



ITEM	FEATURE	SNR
ATP5020	Cooled	3000:1
ATP5001	Cooled	1500:1
ATP2000P	Uncooled	800:1

Fig 4 Multi-parameter Water Quality Analyzer Graph

	ATHB300-1	ATHB300-2	ATHB300-3	ATHB300-4
Output	RS485/Modbus			
Accuracy	3%	2%	0.8%	0.5%
Light Source	Pulsed Xenon Light Source		Deuterium Halogen Light Source	
Light Transmission	Low consumption, large diameter fiber			
Optical Lens	UV quartz glass, high-performance coating film			
Aperture	5 mm			
光谱仪	ATP2000P	ATP5020	ATP2000P	ATP5020
Spectral Rang（nm）	190-1000			
SNR	600:1	3000:1	600:1	3000:1
Dynamic Range	1300:1	15000:1	1300:1	15000:1
Sensitivity	1300 V/(lx·s)	6.5μV/e⁻	1300 V/(lx·s)	6.5μV/e⁻
Detector	Uncooled	Cooled	Uncooled	Cooled
Operating Temp（℃）	-20-45	-20-45	-20-45	-20-45
Resolution（nm）	<0.5(200-400nm)			
System				
Power（V）	12VDC±5%	12VDC±5%	12VDC±5%	12VDC±5%
Current（mA）	330	600	800	1200

1）Light Source

a . Available in ATG1020 Deuterium Halogen Light Source and ATG1030 Pulsed Xenon Light Source, with advantage of compact size, life span over 2000hrs, high stability < 5‰/h，Adjustable output light can satisfy different requirements in lab experiment.

b.ATG1030 Pulsed Xenon Light Source, Wavelength range between 200-900nm，Low consumption, compact size, high light efficiency, long life span(continuous flash 109 times), flash stability>99.99%.

2）Spectrometer provides both types of cooled and uncooled, and cooled techniques enables CCD workable in lower temperature, reduce system noise, and increase sensitivity, as a result of higher accuracy and more stable. All spectrometers can receive SMA905 port or free space according to integration time to be fixed and perform measurement, and also detect result can output via high-speed USB2.0 or UART.

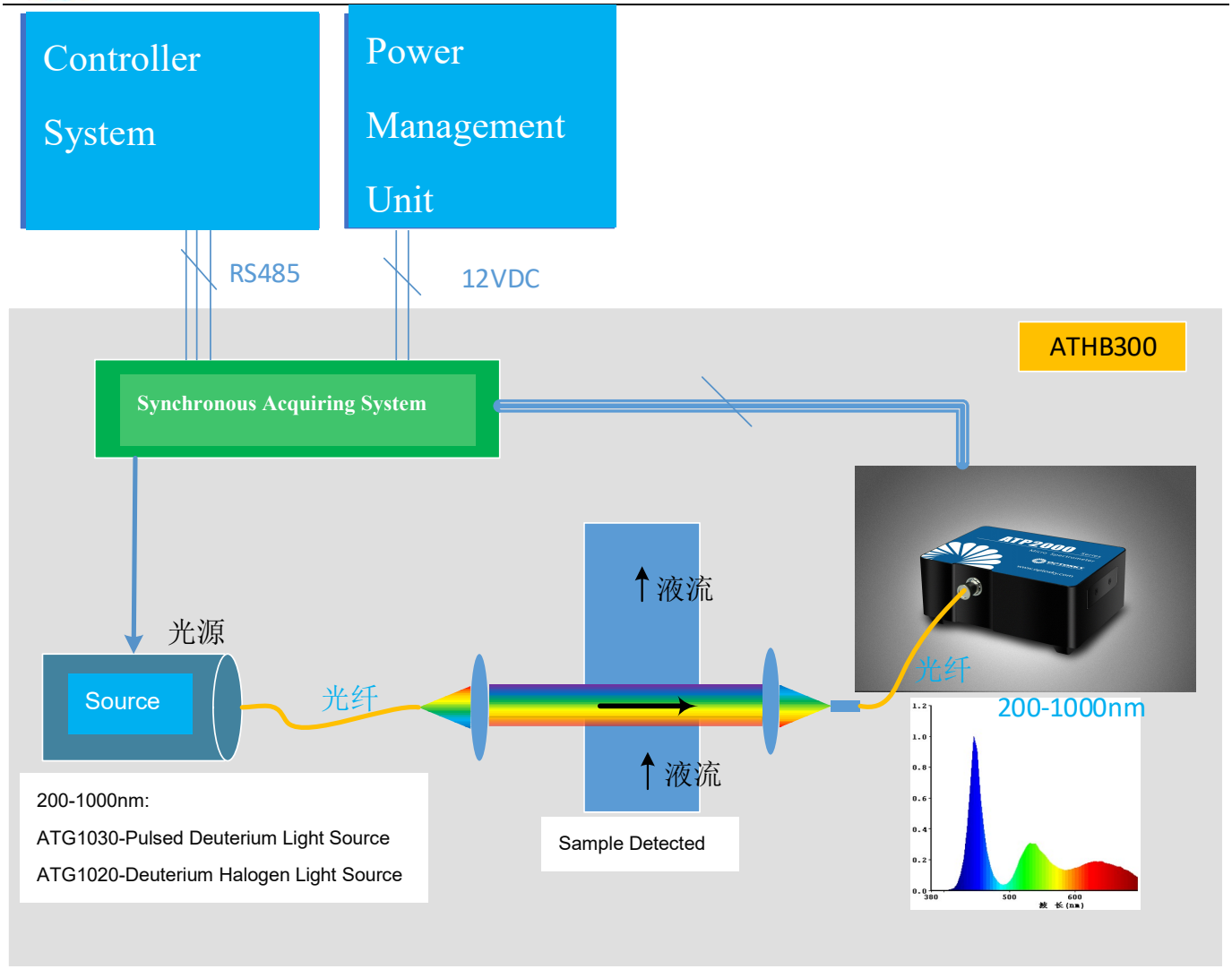
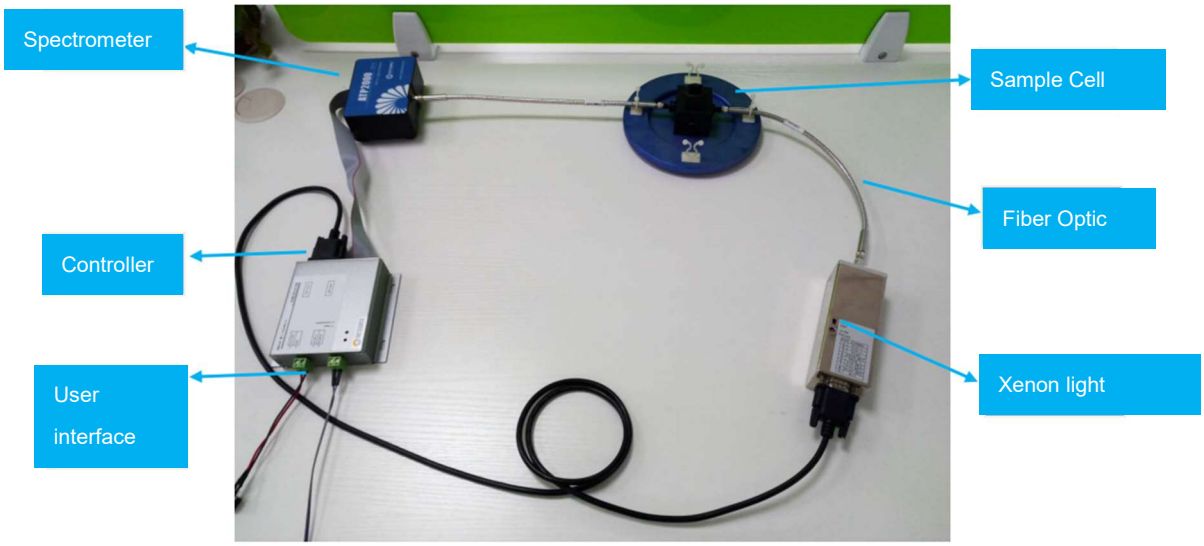


Fig 5 Solution Principle， User is only required to DC12V, sent order or read data via RS485 port



Users can plug-in power and put through RS485, system can be workable, ATHB300 can only receive order fromRS485, and acquire data , then sent back via RS485.