Operating Manual

4530F Atomic Absorption Spectrometer

P/N: ASA1.670.802SM
Version No.: 2008/10

Operation Safety Notice

- No open fire in the lab housing a 4530F atomic absorption spectrophotometer. Acetylene cylinders and 4530F atomic

absorption spectrophotometers shall not be kept in the same room.

- ✧ The room housing acetylene cylinders shall be well ventilated, and no open fire is allowed.
- ✧ The acetylene flow shall not exceed 3L/min upon ignition, and water seal shall be in place in the drain tubing before ignition.
- ✧ The output pressure of an acetylene cylinder shall not exceed 0.12 MPa.
- ✧ The operator shall always attend the instrument after ignition.
- ✧ To extinguish the flame, turn off the acetylene cylinder first. After the flame is extinguished, press the "Test" key in "Flame atomizer settings" until the residual acetylene in the tubing is empted.
- ✧ Please read this manual carefully before operating the 4530F atomic absorption spectrophotometer.

Safety Signs

PRECAUTIONS	Precautions indicate possible damage to the operator.
ATTENTION	Attentions indicate possible damage to work of the operator.

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Overview

General Information

The 4530F atomic absorption spectrophotometer is a single-beam instrument, equipped with a PC and dedicated programs for function controlling and data processing, for testing macro, micro and trace metal elements and semimetal elements.

The instrument provides continuous, peak height and peak area readings for determination of absorbance, concentration and emission intensity, and offers atomic absorption, background absorption and background correction modes, with integration time of 0.1 seconds through 60 seconds. PC menus are used to set the lamp currents, negative high voltages, working wavelengths and combustion conditions for the instrument. Functions available include automatic gain, background correction, automatic energy balance, wavelength scanning, automatic peak finding with peak values, etc. All readings, measurement results, correction curves and operating conditions can be printed.

The instrument provides concentration correction of 1-9 points, allows slope factor adjustment with a single standard sample, offers linear regression, curve fitting, linear and nonlinear standard addition method determination as well as baseline compensation, averages and relative standard deviation, etc.

The instrument complies with the enterprise standard Q31/0104000010C017.

Construction and Working Principles

Atomic absorption spectroscopy is a measurement method based on the absorption by ground-state atoms of characteristic wavelengths.

Normally, atoms are in the ground state. For each element, the energy for their atoms to transit from the ground state to the exited state is known and called characteristic spectral lines. For atomic absorption spectroscopy, a hollow cathode lamp (HCL) is used as the light source to emit the light of the wavelength characteristic of an element. Then the light passes through the atom vapor which absorbs the light of the characteristic wavelength. The concentration of atom concentration of the element is calculated based on the absorption of the light.

After a beam with intensity of I_0 passes through the media with atomic concentration of C, the intensity is decreased to I, by following the Lambert–Beer law.

$$A = \lg(I_0 / I) = KCL$$

A: Absorbance
I_0: Incident ray intensity of characteristic spectral lines
I: Emergent ray intensity of characteristic spectral lines
k: Absorbance factor
L: Flame distance passed by ray of characteristic spectral lines
C: Atomic concentration

The equation indicates that the absorbance and atomic concentration is in a linear relationship in certain circumstances.

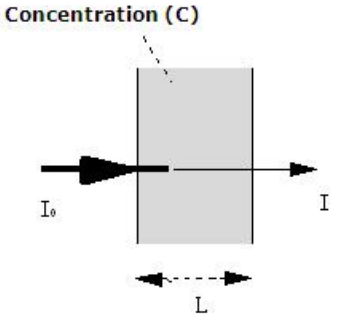


Figure 1-1 Atomic Absorption Diagram

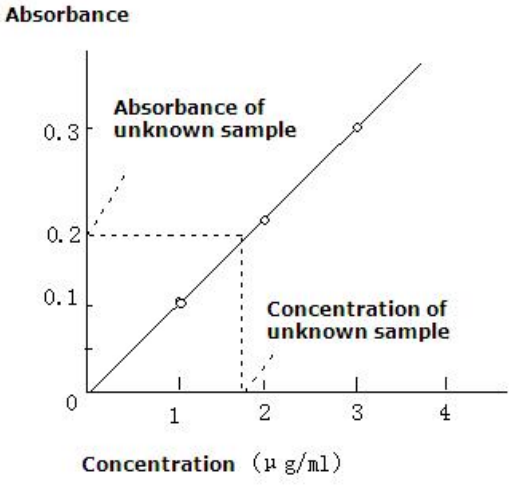
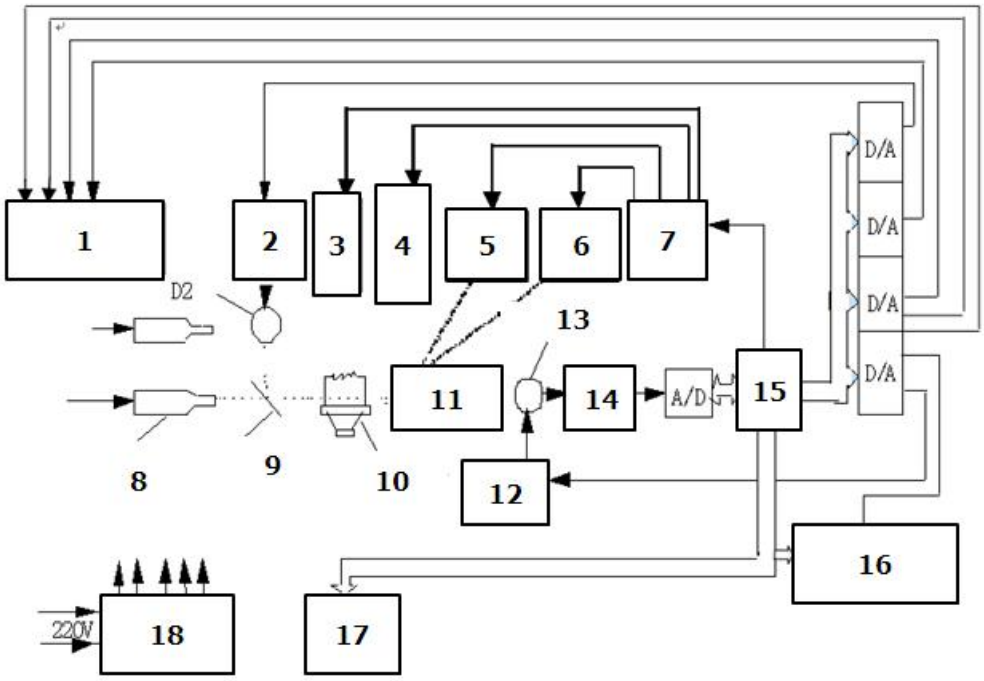


Figure 1-2 Standard Curve Diagram

As shown in Figure 1-2, the relationship between the concentration of a standard sample (e.g. 1μg/ml, 2μg/ml and 3μg/ml) and its absorbance can be plotted into a line, which is called the standard curve of the characteristic element. The concentration of the element contained in an unknown sample can be determined with the standard curve method as shown in Figure 1-2.

The 4530F atomic absorption spectrophotometer mainly comprises one optical system, one signal system and one gas control system.

See Figures 1-3, 1-4 and 1-5 for illustration of the signal system, optical system and gas control system.



1.	Hollow cathode lamp power supply *6*8	2.	D2 lamp power supply
3.	Lamp holder step motor	4.	Lifting platform step motor
5.	Slit step motor	6.	Wavelength step motor
7.	Step motor drive	8.	Hollow cathode lamp
9.	Beam splitter	10.	Atomization system
11.	Monochromator	12.	Negative high voltage
13.	photomultiplier tube	14.	Front mounting
15.	Microcomputer	16.	Gas flow adjustment
17.	Computer system	18.	DC constant voltage power supply

Figure 1-3 Signal System of 4530F

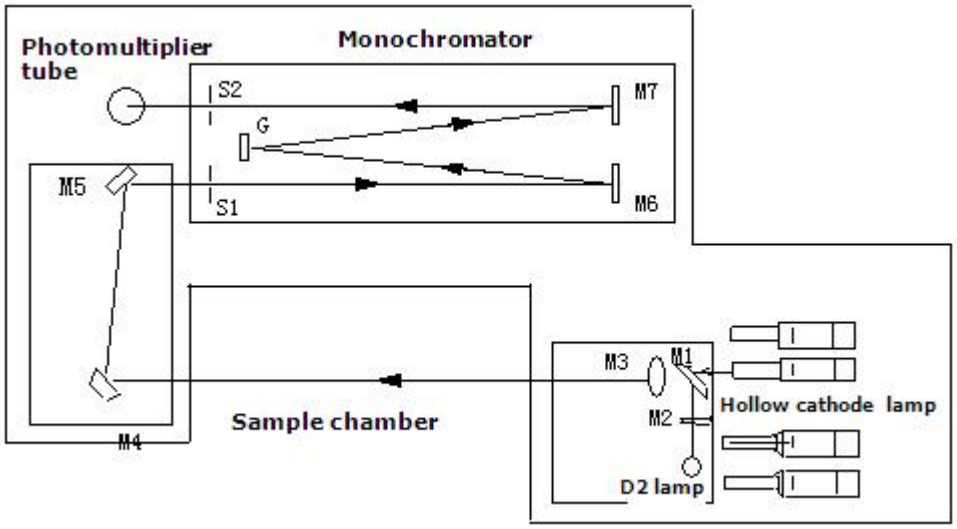


Figure 1-4 Optical System of 4530F

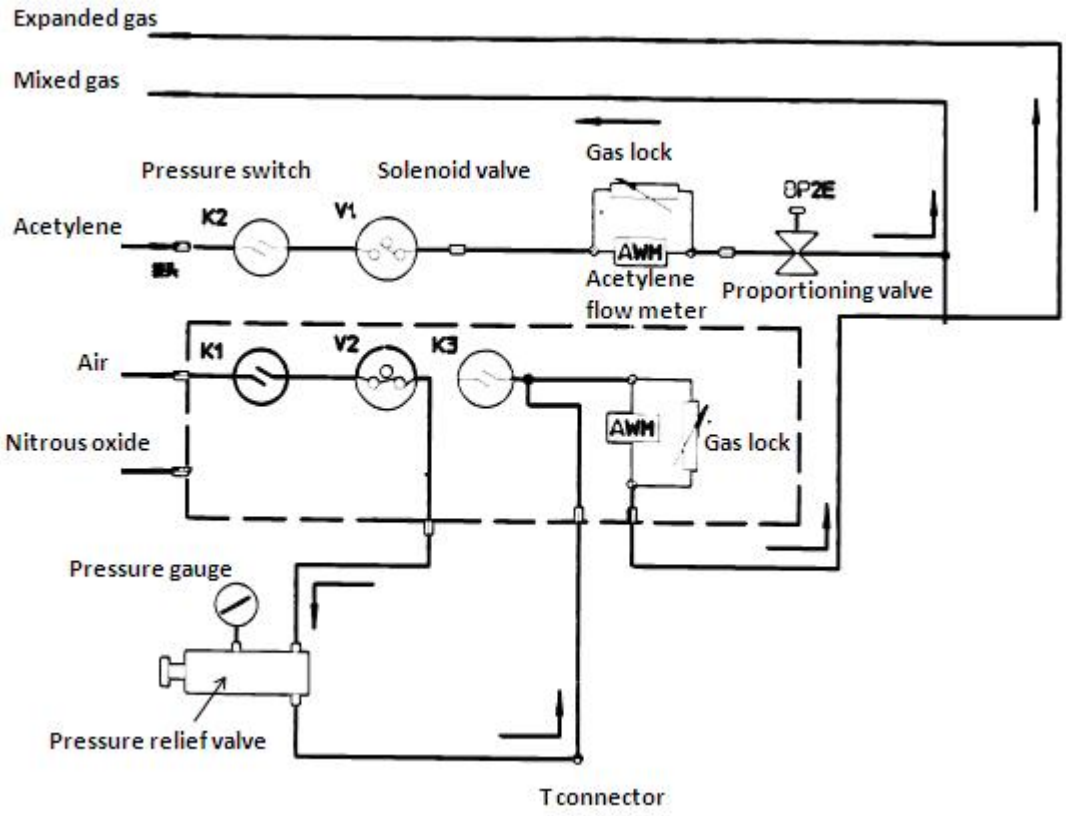


Figure 1-5(a) Gas System of 4530F

Technical Specifications

1. Monochromator

Type:	Czerny-Turner
Wavelength range:	190.0 nm - 900.0 nm
Wavelength accuracy:	Full range ≤ ±0.15 nm
Wavelength repeatability:	≤ 0.04 nm
Grating blaze wavelength:	250 nm

2. Spectrum bandwidth: 0.1 nm, 0.2 nm, 0.4 nm, 1 nm and 2 nm

3. Resolution

   Two spectral lines of Mn at 279.5nm and 279.8nm can be separated with the spectral bandwidth being 0.2nm.

4. Photometer

* Single beam "AC" system (pulsed light source)
* Deuterium lamp as continuous spectrum for background correction

5. Readings

   4-digit display; 5 and 6 digits possible under extended conditions; display of values of absorbance, concentration, emission intensity as well as lamp currents and negative high voltages; printing, plotting and tabulation of readings

Reading types:	continuous, peak height and peak area
Signal types:	Atomic absorption, background absorption, background correction, emission intensity
Integration time:	0.1 – 60 seconds (0.1 increment)
Scale expansion:	0.1 - 100 times
Absorbance range:	-0.1 - 2.000 (Abs)
Wavelength display:	4 digits
Energy display:	2 digits

6. PC menus and functions

* Menus for setting lamp currents, negative high voltages, working wavelengths and other conditions
* Variable wavelength scanning rates, automatic peak finding, background correction, automatic energy balance, automatic gain, and zero
* Standard concentration calibration of 1-9 points, and slope factor adjustment with a single-point standard sample

* Linear regression, curve fitting, and linear and nonlinear standard addition measurement of 1-9 points

* Calculation of average accuracy

* Operation error indication

7. Gas control

* Interlock safety mechanism

* Ignition only possible when the gas pressure is normal and the burner is properly installed

* Selection air-acetylene; and detection and adjustment of gas flow

* Automatic ignition only possible in the air-acetylene mode

* Automatic shutoff of gas and flame extinguishing in the case of failure or gas supply

* Ignored operation errors

8. Combustion system

* Premix expansion chamber with explosion protection devices

* High efficiency glass nebulizer

9. Stability

   Drift ≤ 0.002 Abs/30 min, testing of baseline stability of copper spectral lines at 324.7 nm after half hour of warm-up of the instrument and copper lamp under normal conditions

10. Determination of typical element

Element	Wavelength (nm)	Sensitivity/Characteristic concentration (μg/ml)	Detection limit (μg/ml)
Cu	324.7	0.02	0.004

11. Accuracy: ≤ 0.5% (AA flame Cu)

12. Power supply 220 V±22 V 50 Hz, 200W

Dimensions and Weight

Dimensions: 4530F Main Device: 700 mm (W) × 550 mm (D) × 530 mm (H) (combustion chamber)

Net weight: 80 kg

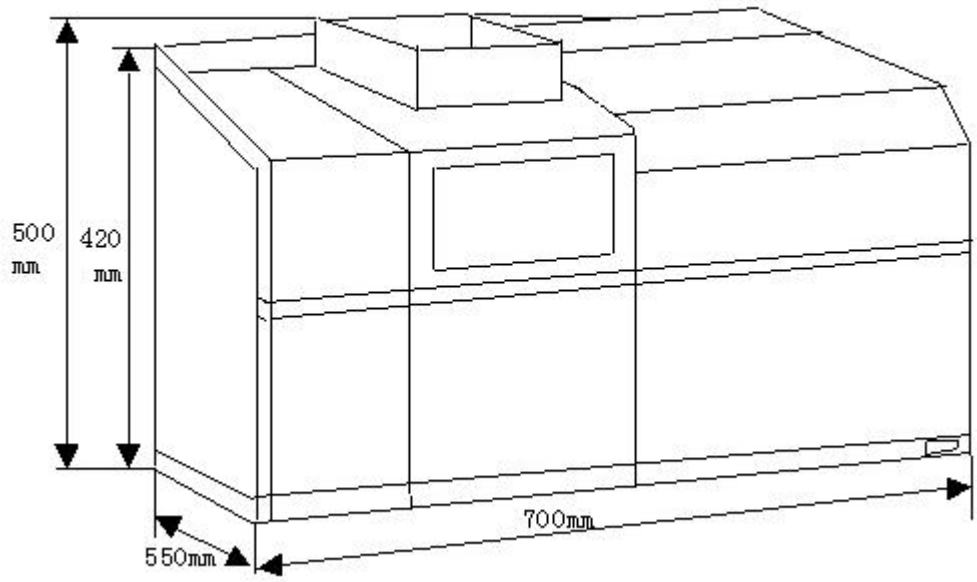


Figure 1-6 Dimensions of 4530F Atomic Absorption Spectrometer

2

Installation and Testing

Lab

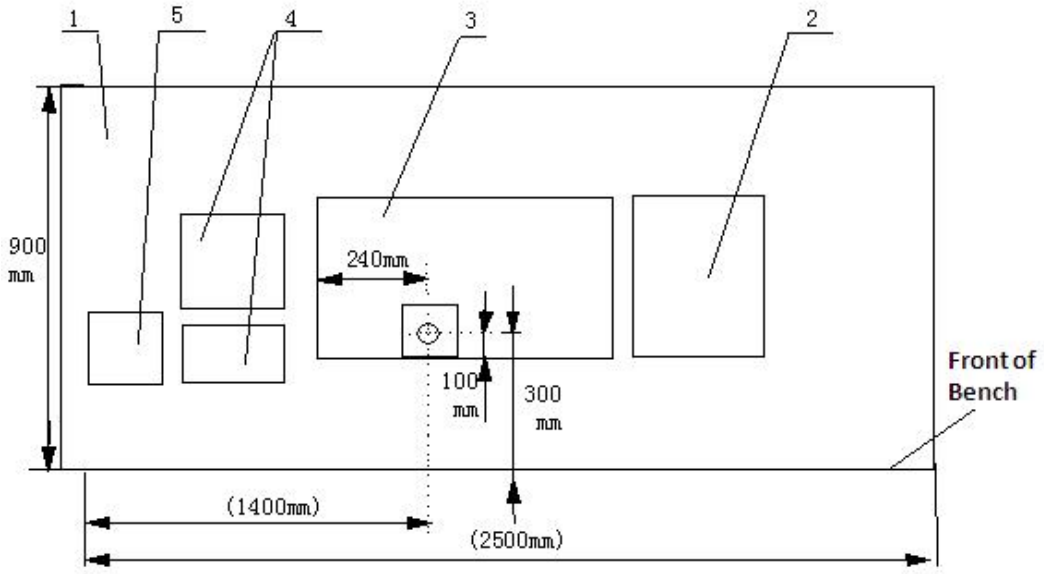
The 4530F atomic absorption spectrometer should be kept in a clean lab room without corrosive substances, with indoor temperatures within 10-30 °C, and relative humanity of air less than 85%.

Workbench and Exhaust Pipes

The workbench should be strong enough and shockproof. The workbench should be flat and have a hole of a diameter of 8-10 cm for drain pipes. See Figure 2-1(A) for the workbench dimensions, and arrangement of the principal instrument and the accessories, and see Figure 2-1(b) for arrangement of the ventilation equipment.

For servicing purpose, a passageway accessible to one operator should be left behind the workbench.

Moreover, ventilation equipment should be installed 30cm above the combustion chamber to discharge hazardous smoke and corrosive vapors from the flame, for protecting health of operators and elongating the life of the instrument. It is recommended to fabricate the ventilation equipment with stainless steel with dimensions shown in Figure 2-1(B).



1. Workbench 2. Power supply for graphite furnace (optional)
3. 4530F 4. PC 5. Printer

Figure 2-1(A) Workbench Dimensions

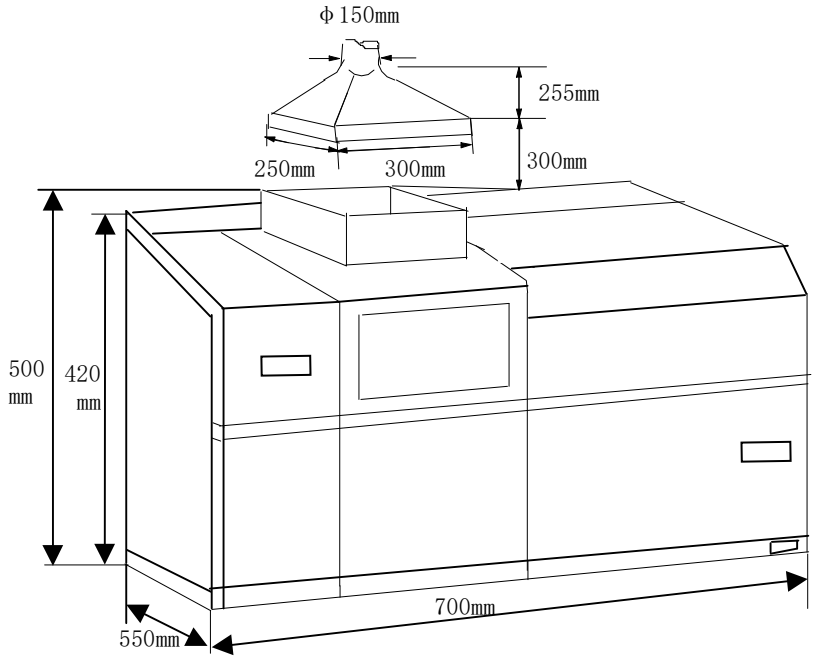


Figure 2-1(B) Schematic diagram of Ventilation Equipment

Supply of Power, Gases and Water

The lab shall be supplied with single-phase AC power of 220 V ± 22 V at 50 Hz, and the instrument's earthing terminal should be properly earthed. Considering the use of the instrument, air compressor, accessories and service tools, at least eight sockets (250V/10A 3-core) should be provided, and the outlets should be mounted near the workbench.

If a graphite furnace is used, 220V 30A single-phase AC power at 50 Hz should be provided. To avoid interference with the instrument, the power supply should be separately connected to the junction box and can withstand the maximum load with 250V/30A 3-core sockets. There should be the source of cooling water and drain openings inside the lab. The source of cooling water may be tap water or a circulation and cooling system, with a flow rate no less than 2 L/min. The air compressor should be kept several meters away from the instrument at a well-ventilated and clean place. Keep connection plastic pipes always from heat sources. The user should provide acetylene cylinders with back fire arrangement and N_2O. Such cylinders should be kept at a well-ventilated place without open fire within 3 meters, to avoid accidental inflammation or explosion.

Front Panel and Rear Panel

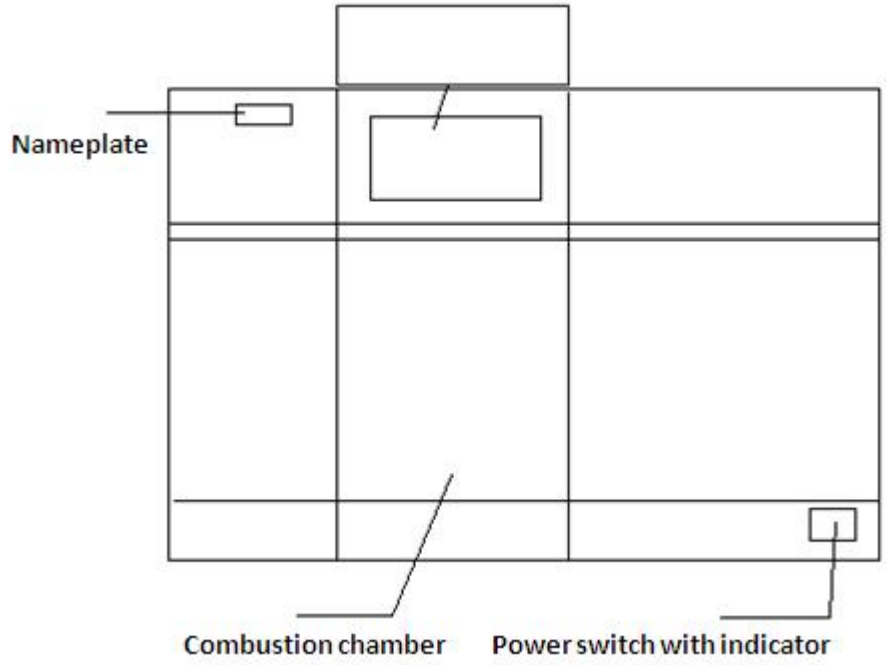


Figure 2-1(C) Front View of Instrument

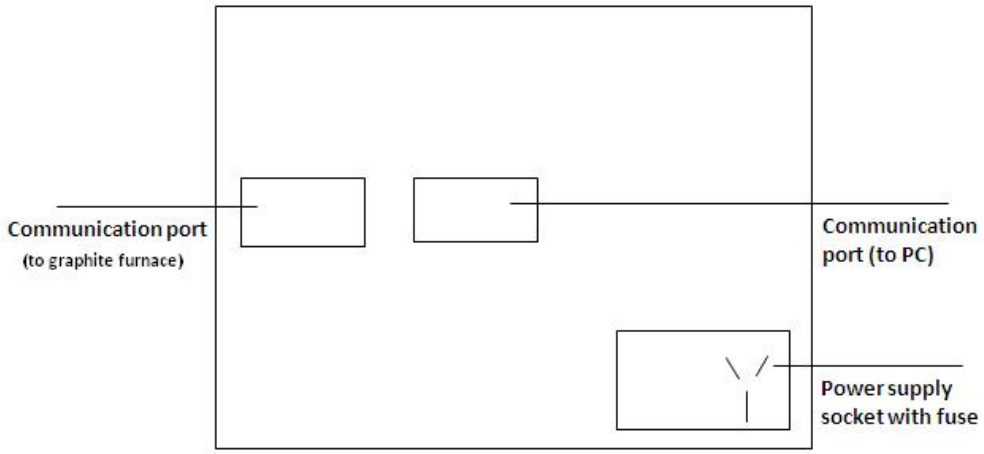
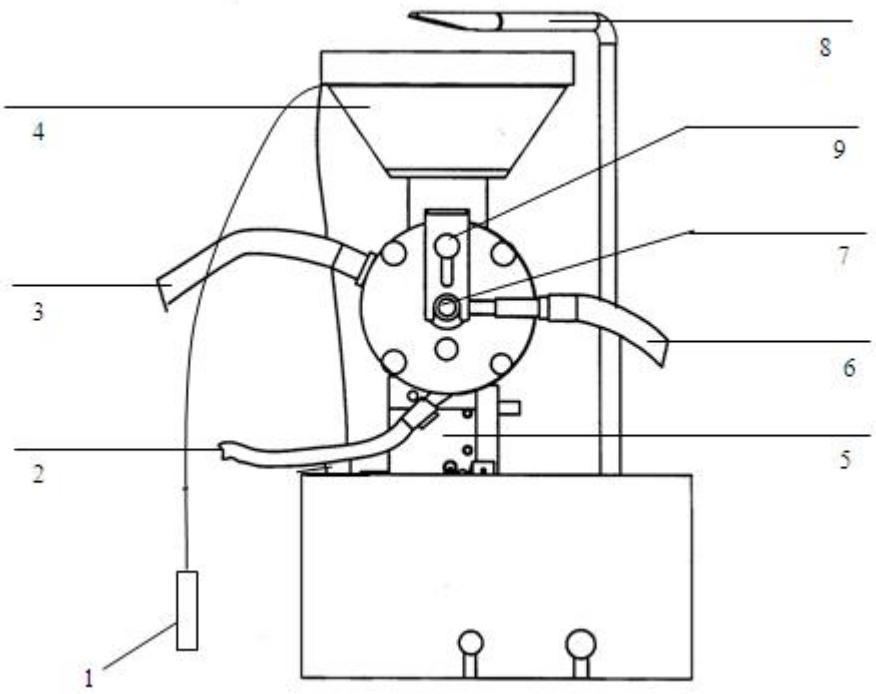


Figure 2-1(D) Rear View of Instrument

Installation

Installation of the Instrument

Place the instrument on a flat and stable workbench. Align the combustion chamber (Figure 2-2) with the ventilation equipment above. The hole on the workbench should be properly located under the combustion chamber. (See Figure 2-1(a))



1. Safety interlock bolt and detection head	2. Drain pipe	3. Mixed gas pipe
4. Burner (50 mm or 100 mm)	5. Automatic lifting platform	6. Expanded gas pipe
7. Nebulizer	8. Igniter	9. Pressing disc

Figure 2-2 Combustion Chamber

1. Attach one end of a drain pipe in an appropriate length onto the drain outlet of the premix chamber. The other end should run through the holes on the bottom plate of the burner, the bottom plate of the entire instrument and the hole of the workbench.
2. Place the base of the premix chamber onto the automatic lifting platform of the burner, and fix it with the screws on the base.
3. Attach a single-slit burner of 100 mm (or 50 mm) on the neck of the premix chamber, and completely insert the safety interlock bolt into the bolt hole if the gas is needed.

4. Arrange the drain pipe under the workbench into a ring with a diameter of 100 mm and fix it with wires, the discharge end of the pipe should be inserted into a plastic container.(Attention: Do not fold or twist the drain pipe.)
5. Connect the mixed gas pipe on the left of the combustion chamber to the premix chamber, and attach it by hand. Then use a 10-mm open mind wrench to fasten it.

Installation of Nebulizer

A: Glass Nebulizer

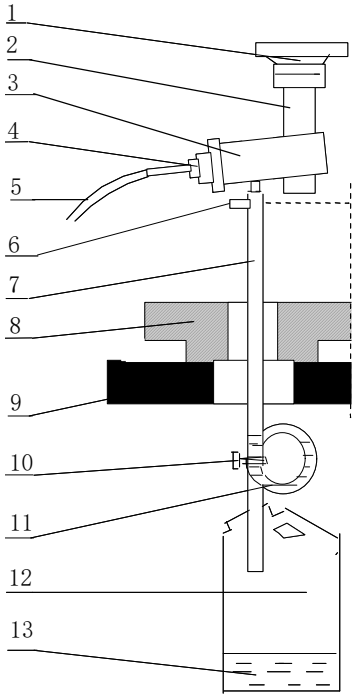
1. Unfasten the screws on the end cover, and lift up the pressing disc.
2. Place the nebulizer in the end cover, and press tight the pressing disc.
3. Connect the expanded gas pipe on the right of the combustion chamber to the inlet of the nebulizer, and attach it by hand. Then use a 10-mm open mind wrench to fasten it.
4. Place a polyethylene capillary tube onto the metal capillary tube at the inlet of the nebulizer.

B: Stainless Steel Nebulizer

1. Remove the front end cover of the premix chamber.
2. Insert the dispersion ball onto the adjustment lever on the end cover; align the center of the dispersion ball with the center hole of the end cover; and fix it with nylon screws.
3. Place a polyethylene plastic capillary tube (φ1.2×0.3, and 150-200 mm long) onto the metal capillary tube at the inlet of the nebulizer.
4. Lift up the pressing disc and place the metal nebulizer; drop the pressing disc and turn tight the screws.
5. Connect the expanded gas pipe on the right of the combustion chamber to the expanded gas inlet of the nebulizer, and attach it by hand. Then use a 10-mm open mind wrench to fasten it.

Water Seal

After the premix chamber, combustion chamber, nebulizer and drain system have been installed properly, remove the burner, and inject about 400 ml water from the neck of the premix chamber (See position 2 in the figure below) to make the drain pipe sealed with water, as shown in Figure 2-3. Attach the burner again.



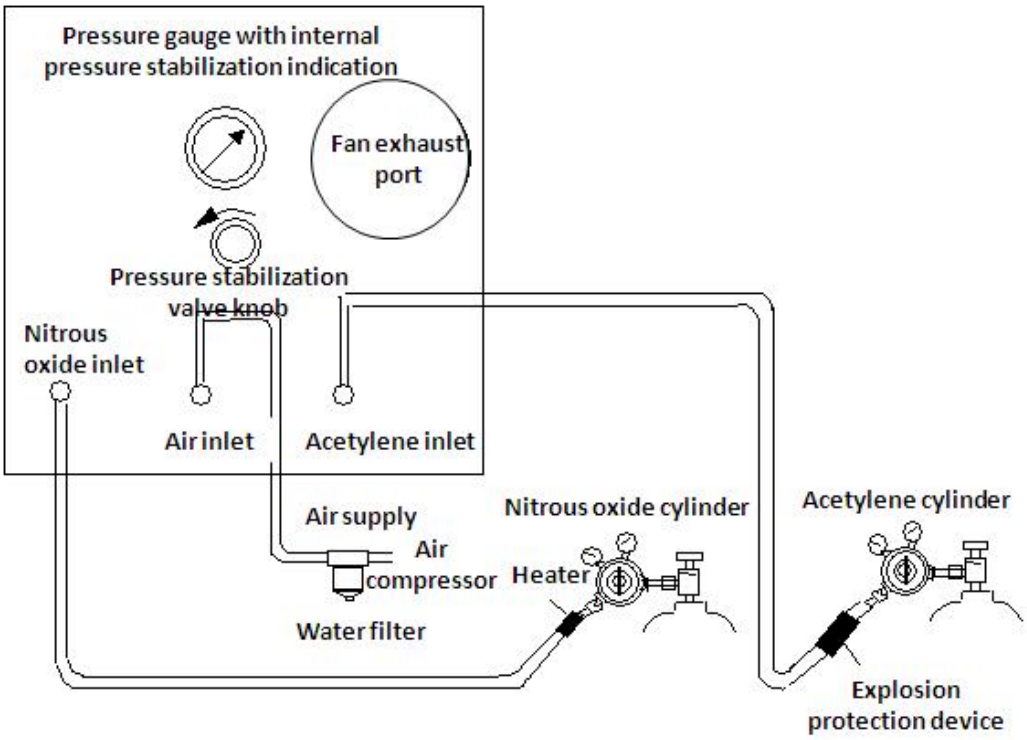
1. Burner
2. Premix chamber neck
3. Premix chamber
4. Nebulizer
5. Sample inlet capillary pipe
6. Bottom plate of combustion chamber
7. Drain pipe
8. Bottom plate of instrument
9. Workbench board
10. Fastening tape
11. Water seal ring
12. Waste liquid container
13. Waste liquid

Figure 2-3 Drain System of Premix Chamber

PRECAUTIONS **CHECK WHETHER THERE IS WATER SEAL IN THE DRAIN PIPE BEFORE IGNITION EVERY TIME!**

Gas Pipes

Connectors to gas pipes are located on the rear of the instrument, as shown in Figure 2-4.



Figures 2-4 Gas Connection

1. Connect one end of the air pipe (φ6×1 nylon pipe) to the air inlet of the instrument, and the other end to the outlet of oilless air compressor via the water separation air filter.
2. Connect one end of the acetylene pipe (φ6×1 nylon pipe) to the acetylene inlet of the instrument, and the other end to a source of clean acetylene.

PRECAUTIONS

1. **CORRECTLY IDENTIFY GAS SOURCES. NEVER CONNECT TO A WRONG GAS SOURCE.**
2. **TURN TIGHT SCREWS OF CONNECTORS TO AVOID GAS LEAKAGE.**
3. **DO NOT USE A COPPER PIPE WITH COPPER CONTENT HIGHER THAN 65% TO CONNECT THE SUPPLY OF ACETYLENE. DO NOT USE PIPES WITH OILS TO CONNECT THE SUPPLY OF GASES TO AVOID SELF SPONTANEOUS IGNITION OR EXPLOSION.**

Installation and Removal of Chimney

The top part of the combustion chamber of 4530F can be removed from the instrument. To remove the chimney, just lift it up. Attach the chimney by placing it back.

Hollow Cathode Lamp

The lamp chamber is located on the right upper part of the instrument. The lamp holder can house 6 and 8 hollow cathode lamps at the same time. While one lamp is used in testing, it is possible to warm up other lamps. Rotate the lamp holder with the AA workstation software to the testing position, and press the fine tuning bottom to place it into the optimal position.

Installation Procedures:

1. Properly insert a hollow cathode lamp into the socket.
2. Place the hollow cathode lamp onto the lamp holder.
3. See page 4-2 for correction of the light source.

Connection of Cables on the Rear of Instrument

1. RS232 port

   The port should be connected with the workstation for control and data processing.

2. Graphite furnace communication port

   The port should be connected with the control of the graphite furnace for controlling temperatures of the oven.

3. Power cords

   After above connection of cables has been completed, connect the power cords of the instrument and the computer while their power switches are at the off position. See Figure 2-1(D).

3

Introduction to Workstation

Software Installation

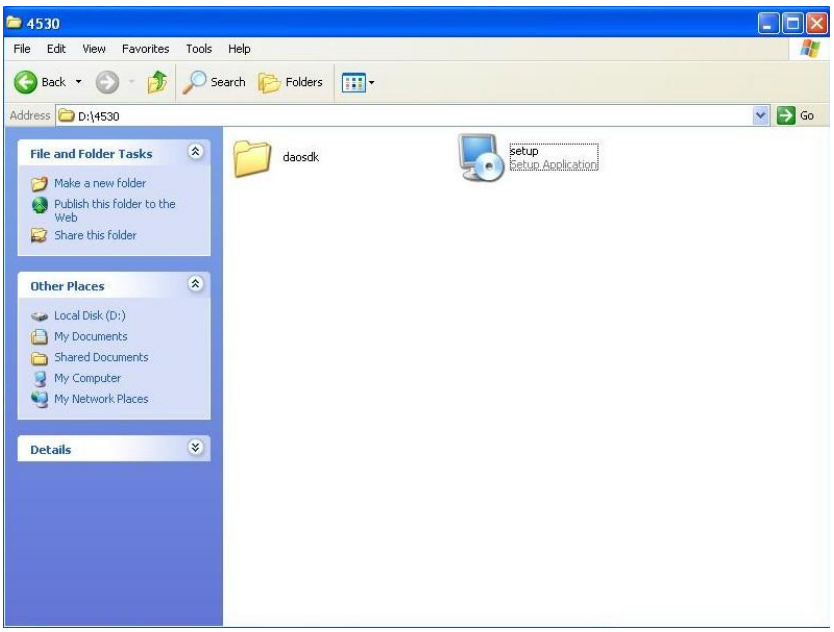
Hardware and Software Specification

- Windows 98/NT/ME/2000, with Windows NT recommended
- Hard disk of 10G or above
- RAM 128 M or above
- 17” or larger color display, with resolution of 1024×768 or above

Software Installation

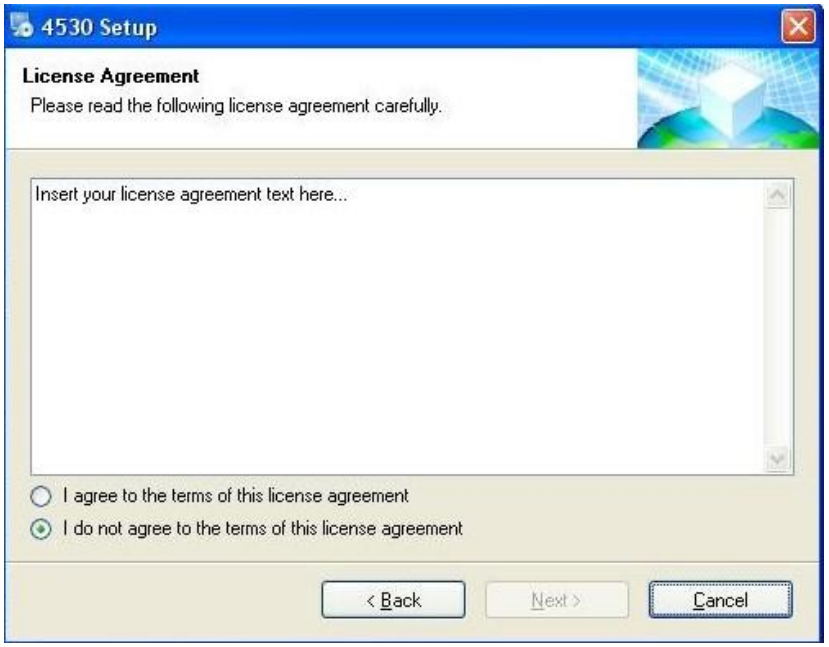
The software installation is simple for the 4530F atomic absorption spectrophotometer. Just follow the steps under Windows OS. Steps are as below:

Insert the installation CD supplied for the AA workstation. Open the Windows Explorer, and select D:\AAsetup\disk1\setup as shown in the figure below:



Double click “Setup”

Click Next



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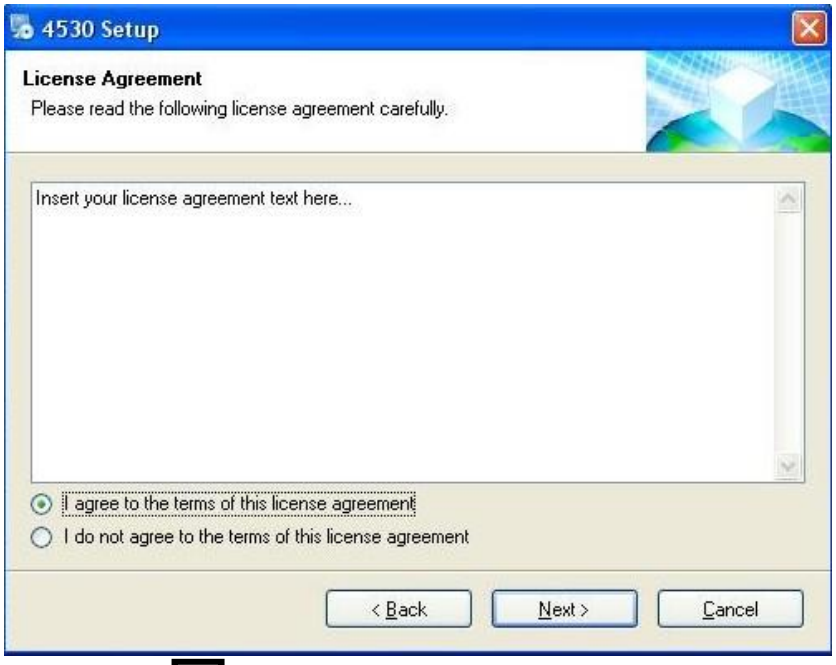

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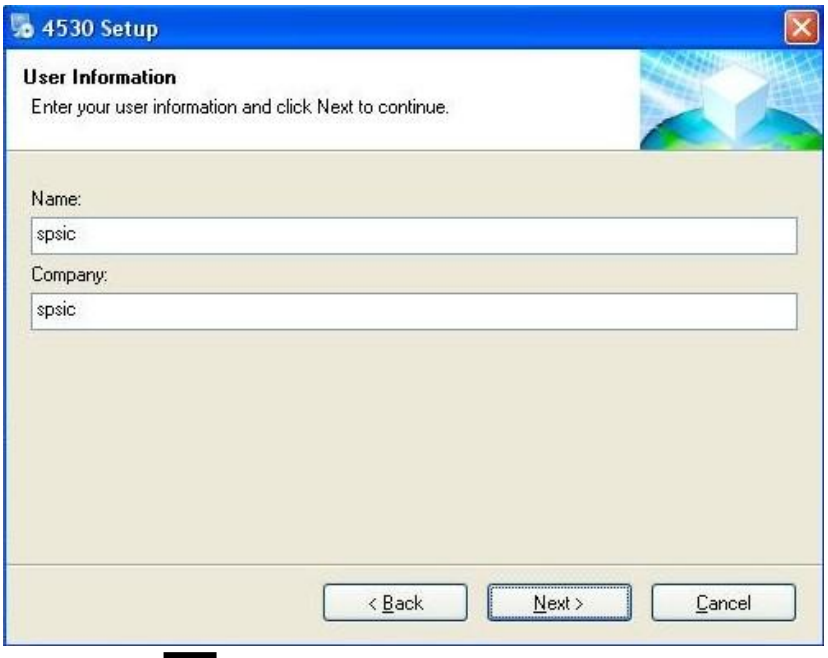

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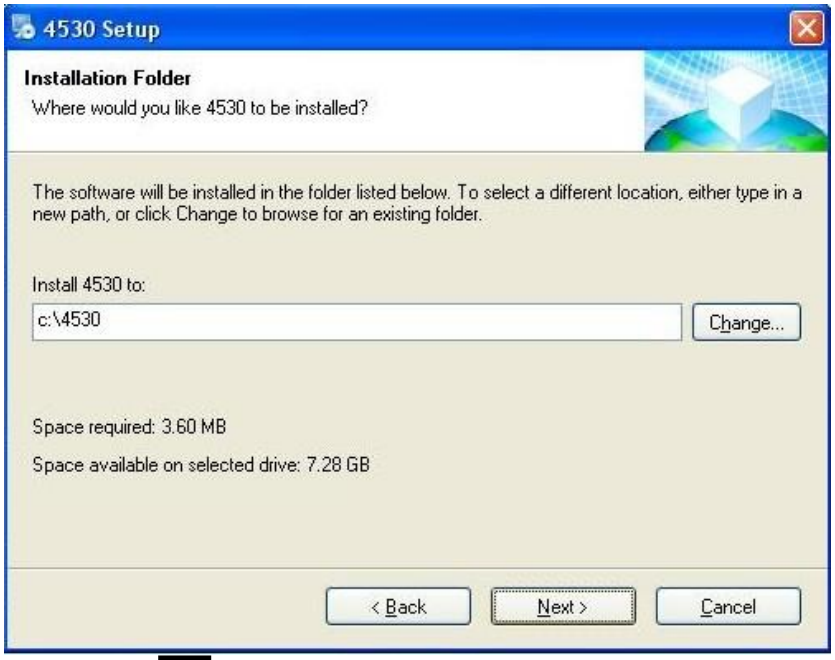

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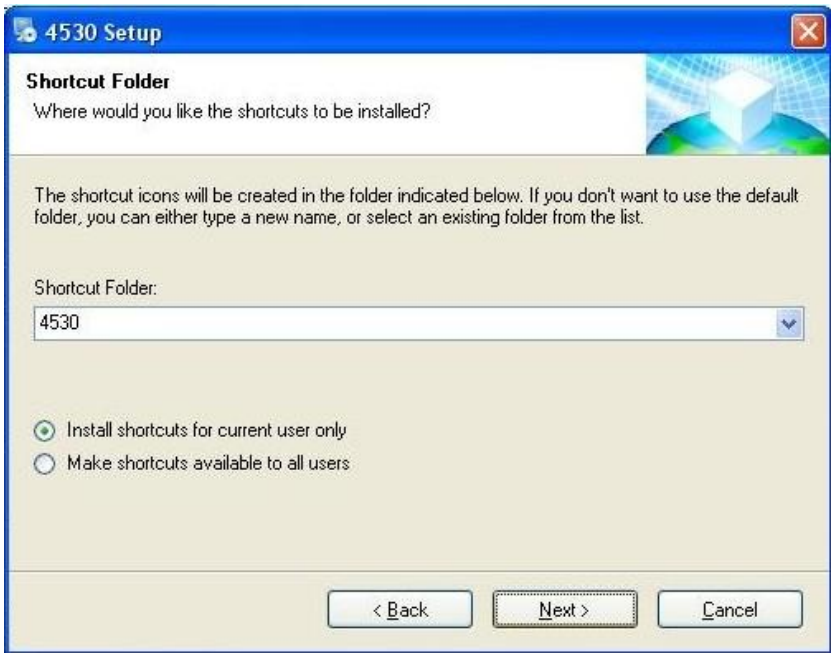

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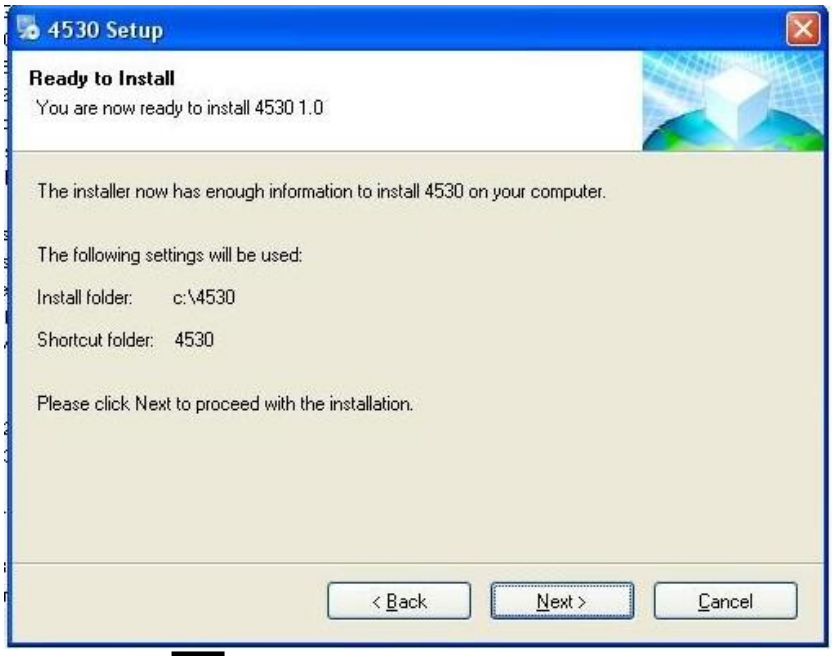

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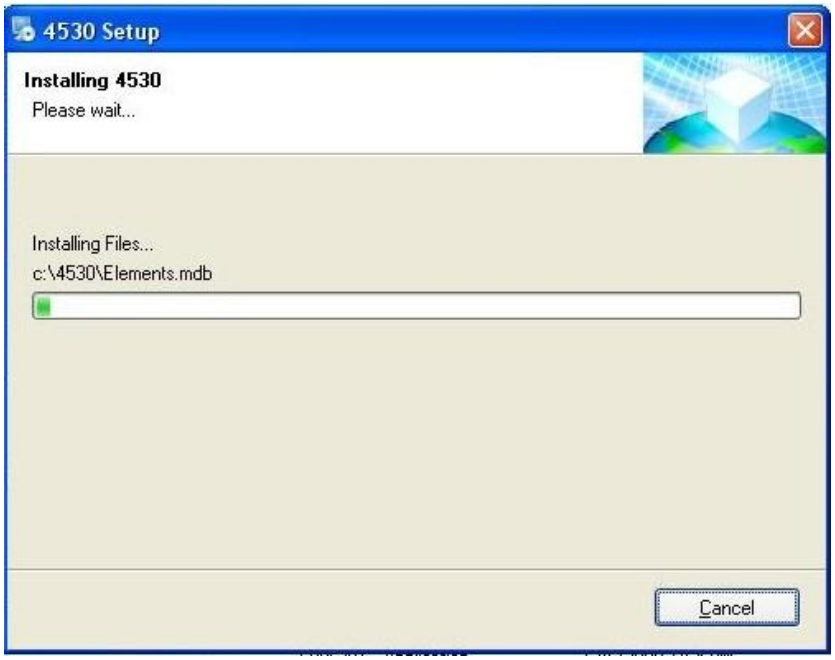
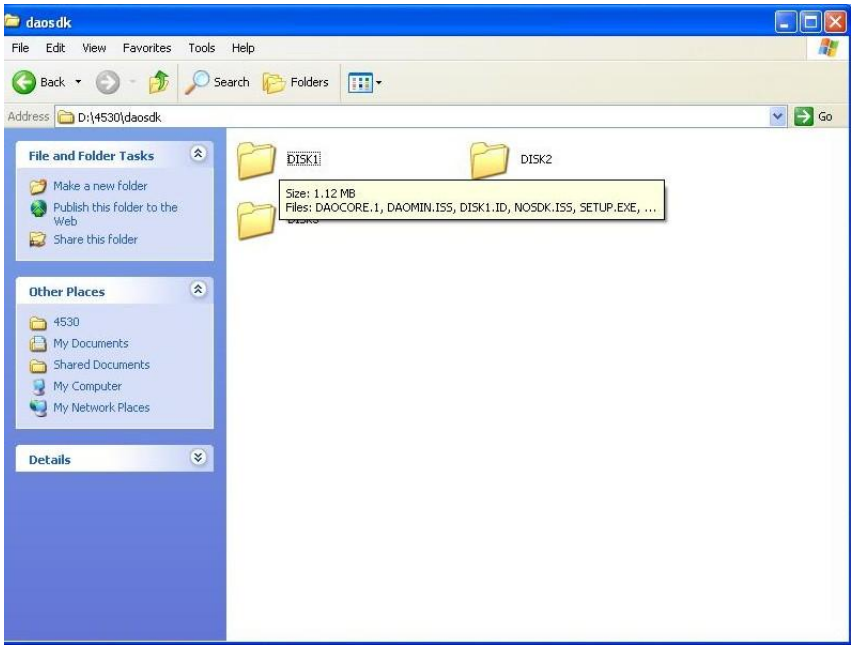


Click Next

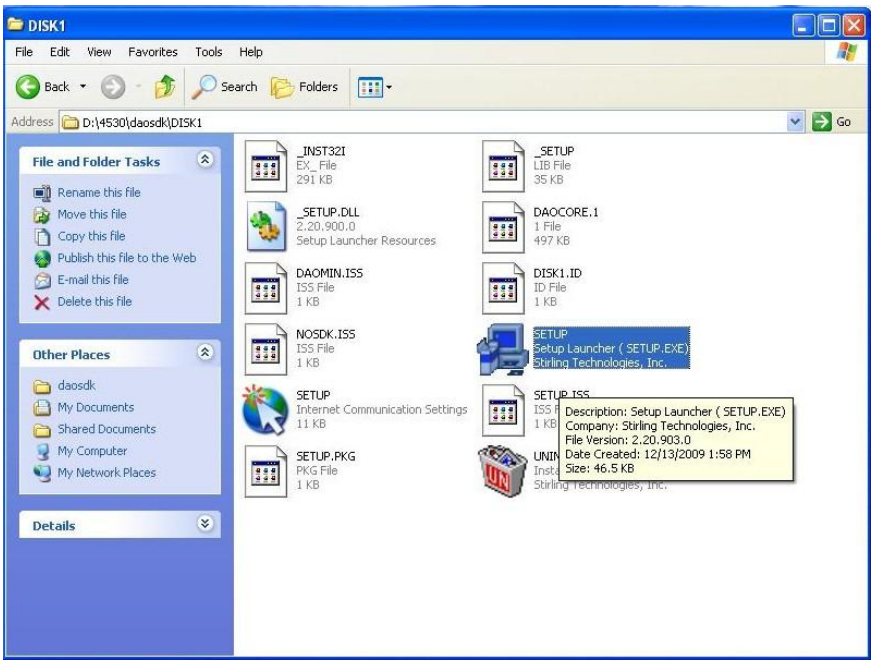
Now, the software of AA workstation has already been installed!

Now, install the database program DAO for the workstation to work.

Install the DAO program. Select daosdk\disk1\setup, as shown in the figure below:



Double click Setup



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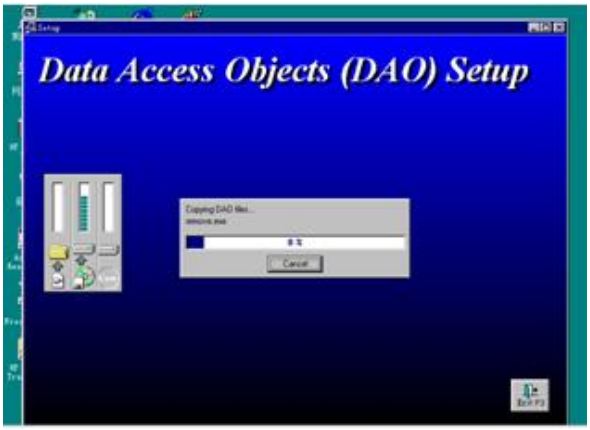

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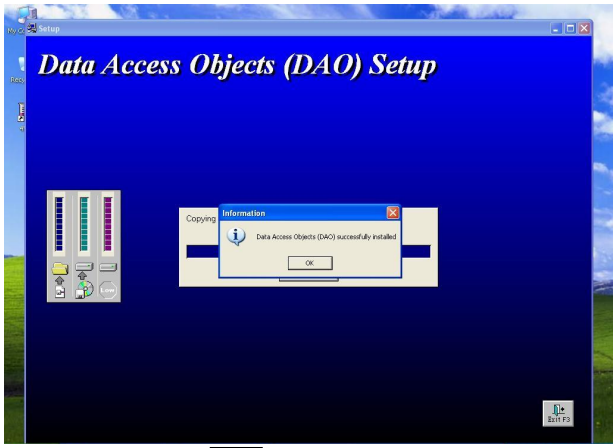
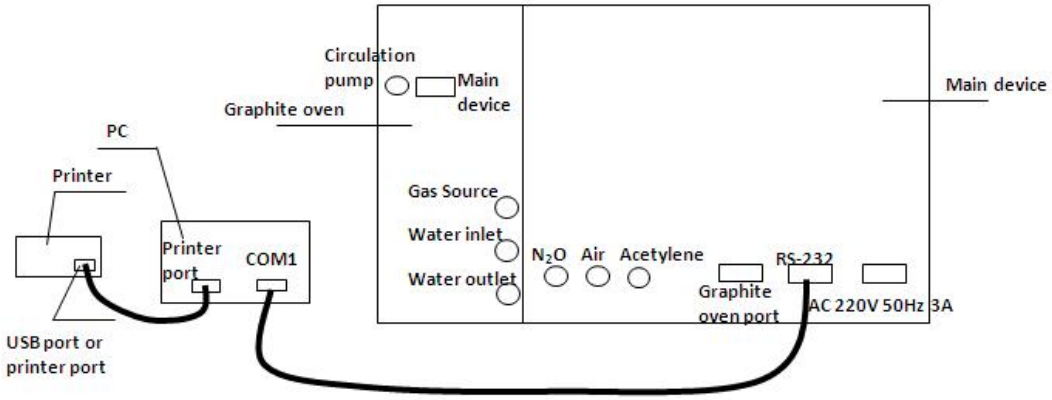


DAO has been installed!

Now, the installation of the 4530F workstation is complete.

Hardware Installation



Rear View of Connection between the Instrument, Printer and PC

Connection of Power Supply

Connection between the Instrument and PC

Connect one end of the cable to a serial port of the PC, and the other end to the RS-232 port of the instrument.

PRECAUTIONS

ALL HARDWARE CONNECTION AND INSTALLATION ACTIVITIES DESCRIBED ABOVE SHOULD BE DONE WHILE THE 4530F INSTRUMENT AND PC ARE TURNED OFF; OTHERWISE, CERTAIN COMPONENTS OF MAY BE DAMAGED.

4

Work with Workstation

Start Equipment

1. Turn on the power of the computer.
2. Select the icon as shown in Figure 4-1. Double click to open the workstation, and a dialog box will appear as shown in Figure 4-1(a).

Figure 4-1

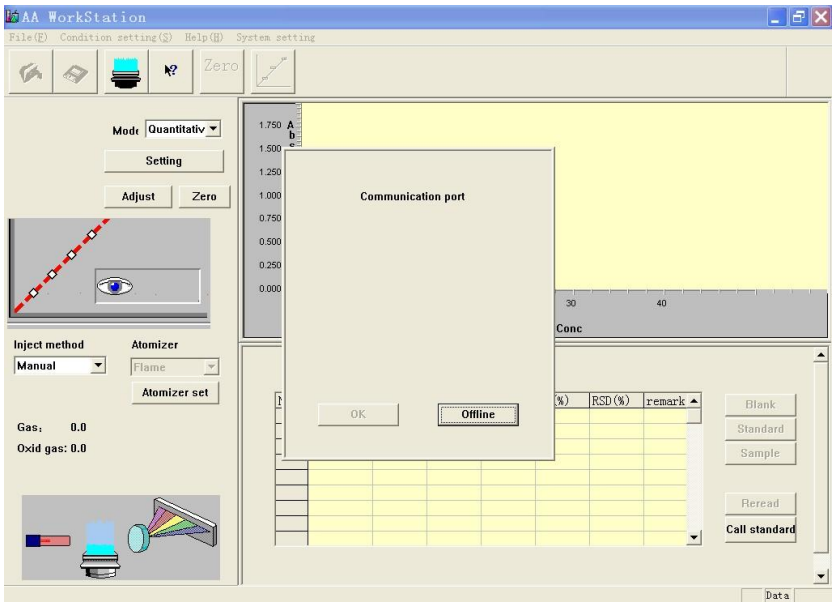


Figure 4-1(a)

3. Turn on the power of the instrument, which will start self-test, as shown in Figure 4-2.

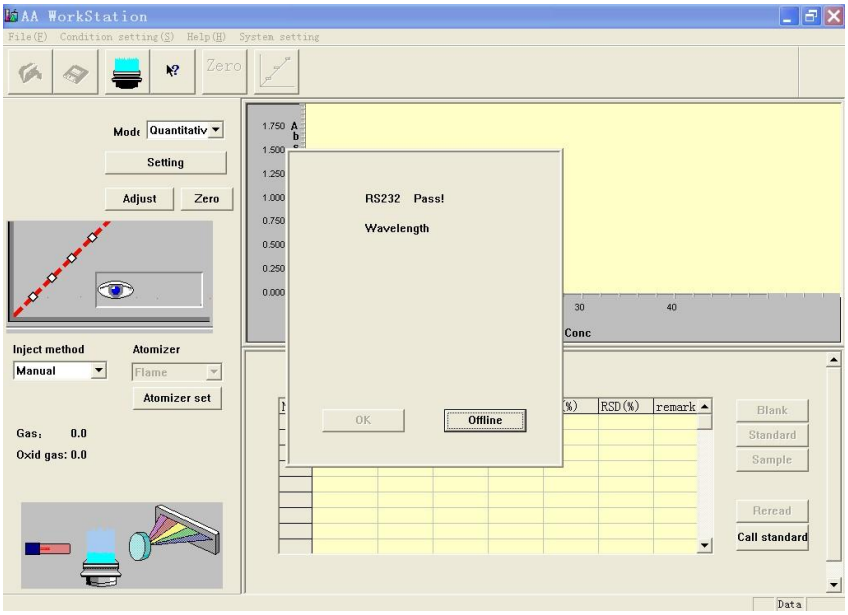


Figure 4-2

ATTENTION

If you want to view measurement results which have been stored in the offline state, press the Offline button when opening the workstation. Close the self-test dialog, and data files can be accessed.

If you want work online in connection with the instrument, restart the workstation.

4. After the self-test, the screen is as shown in Figure 4-3.

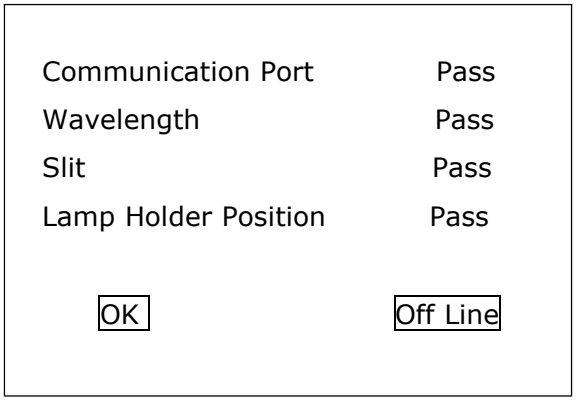


Figure 4-3

ATTENTION **If any self-test item fails (as shown in Figure 4-4), restart the workstation. If the self-test item fails again, please immediately contact our After-Sale Service.**

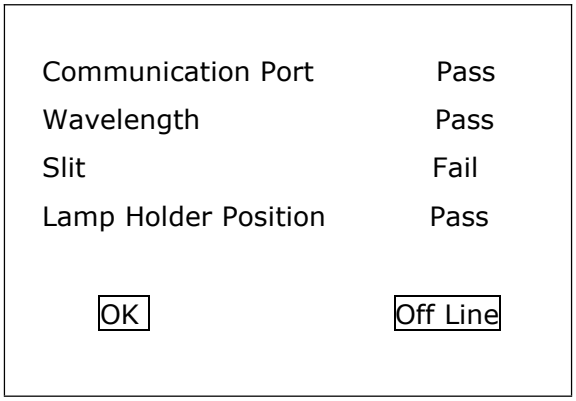


Figure 4-4

5. Press "OK", and the screen is as shown in Figure 4-5.

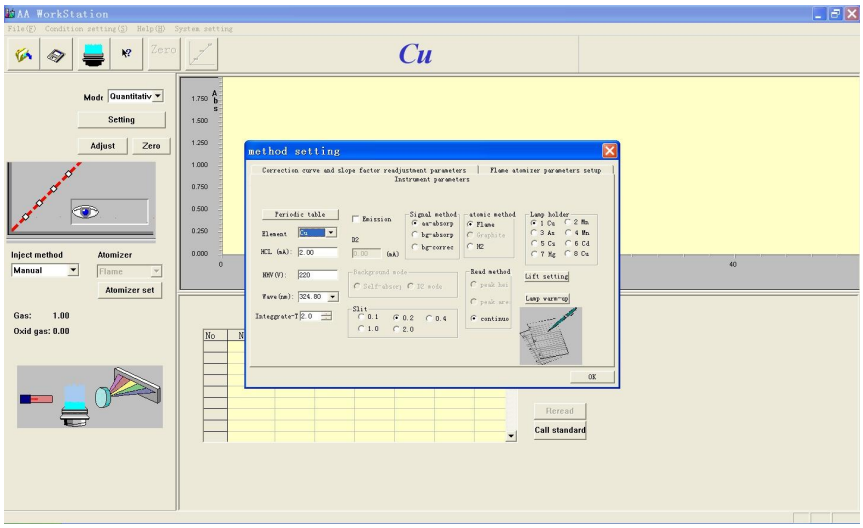


Figure 4-5

You can select desired test conditions and methods here.

Program Window

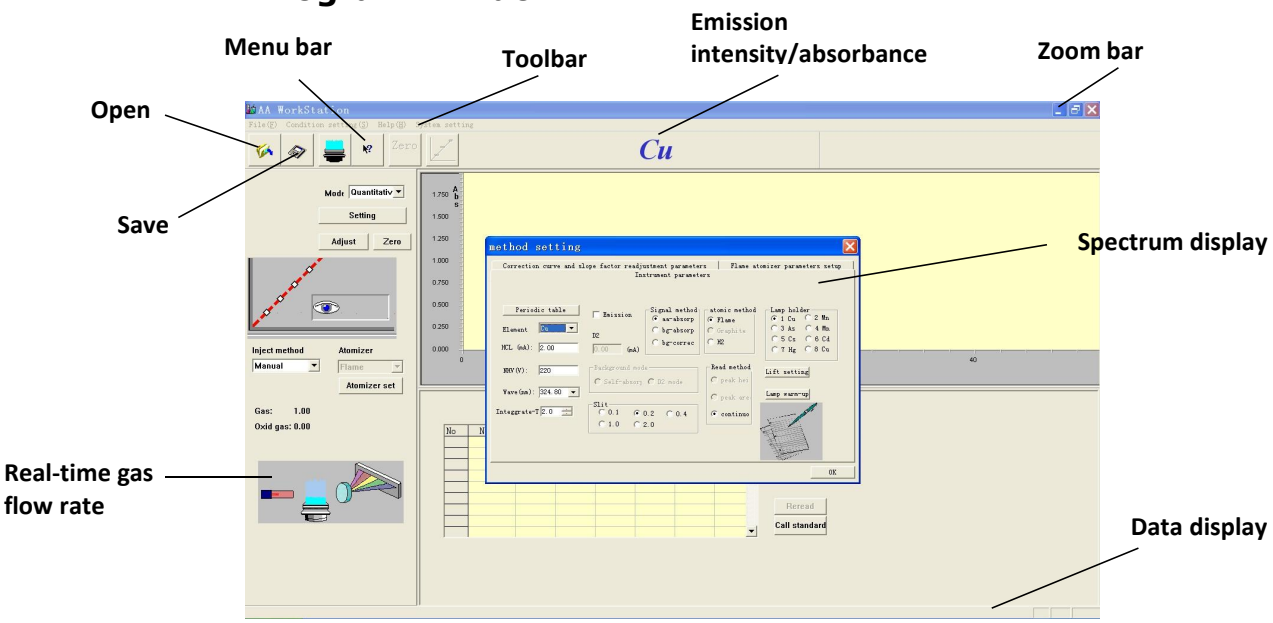


Figure 4-6

Set Password of Workstation

1. Select "System settings > System information" from the menu bar, as shown in Figure 4-7, and a dialog will appear as shown in Figure 4-8.

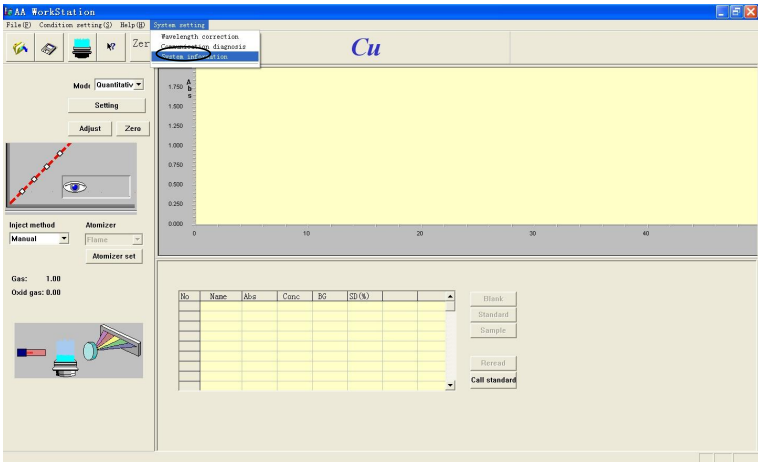


Figure 4-7

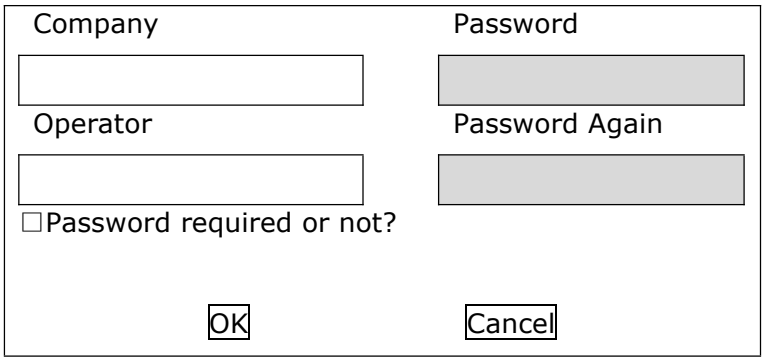


Figure 4-8

2. Check the box next to "Password required or not", and enter the password and re-enter the password for confirmation. See Figure 4-9.

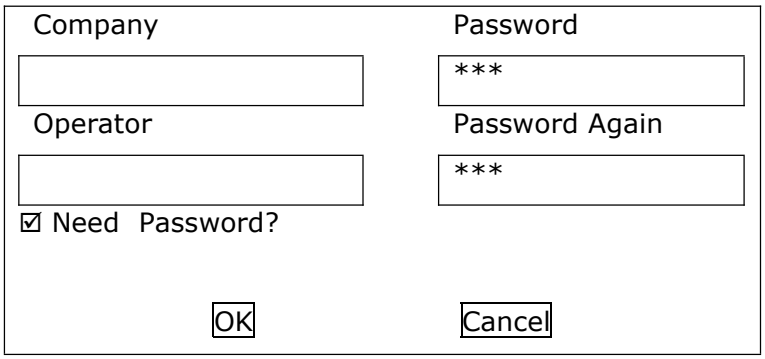


Figure 4-9

3. Press "OK" to save the password.
4. Thereafter, a dialog will appear as shown in Figure 4-10 every time the workstation is started. Enter the correct password and press "OK", before the instrument can start self-test.

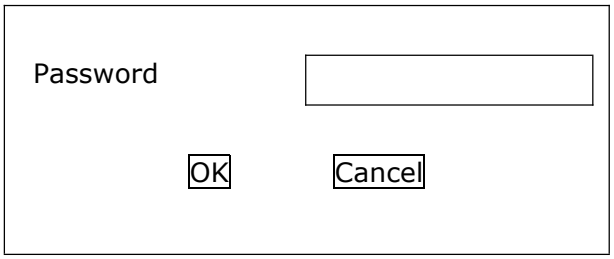


Figure 4-10

ANTTENTION

You may set a desired password for the 4530F workstation based on your needs, or just designate no password.

If you forget your password, reinstall the workstation's software.

Functions of Method Establishment Dialog

The "Method establishment" dialog has tags for "Instrument parameters", "Correction curve and slope factor readjustment parameters", and "Flame atomizer parameter setup" or "Graphite furnace atomizer parameter setup", as shown in Figure 4-11.

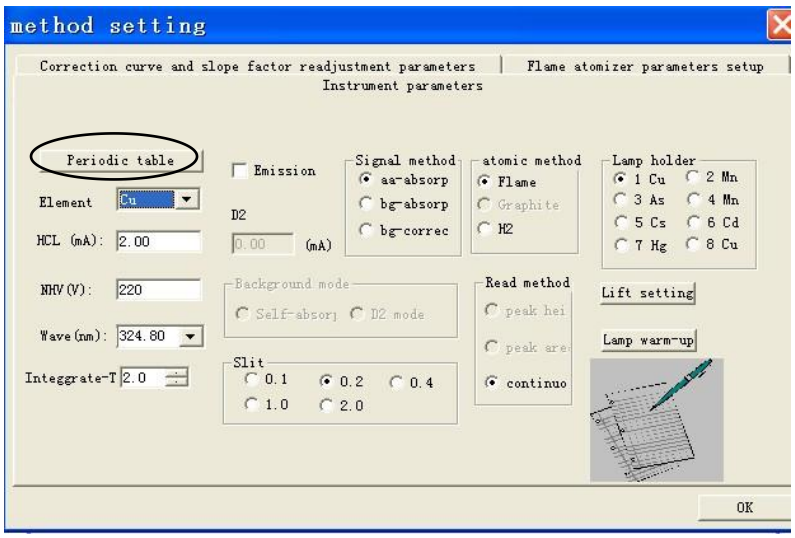


Figure 4-11

Instrument Parameters

1. Element selection: Two methods can be used for element selection. One is clicking the "Periodic table of elements" as shown in Figure 4-11, and a periodic table of elements will appear as shown in Figure 4-12.

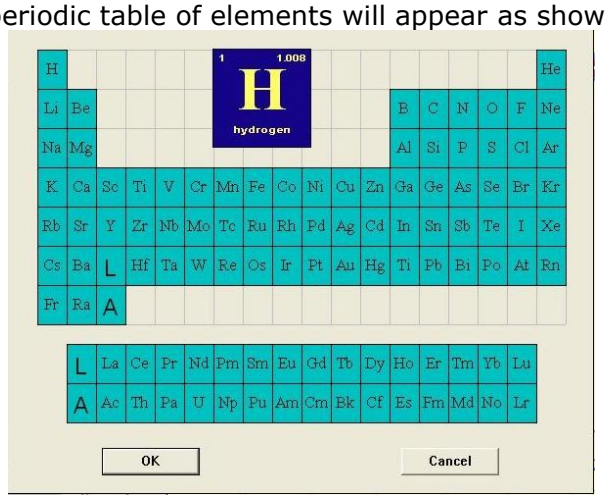


Figure 4-12

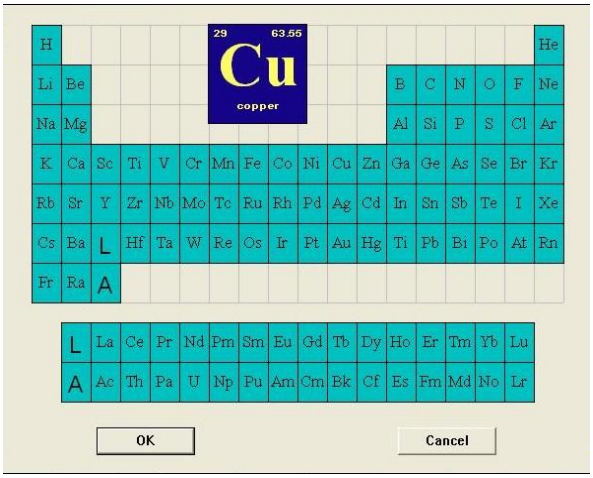


Figure 4-13

2. Select and click on an element with the mouse. The selected element will be shown on a highlighted position, as shown in Figure 4-13.

3. Press "OK" to close the "Periodic table of elements" box, with Cu being selected. If you press "Cancel" to close the "Periodic table of elements" box, no element has been selected.

4. The other method is moving the cursor to the "Element selection" pull-down list to select a element by clicking on it, as shown in Figure 4-14.

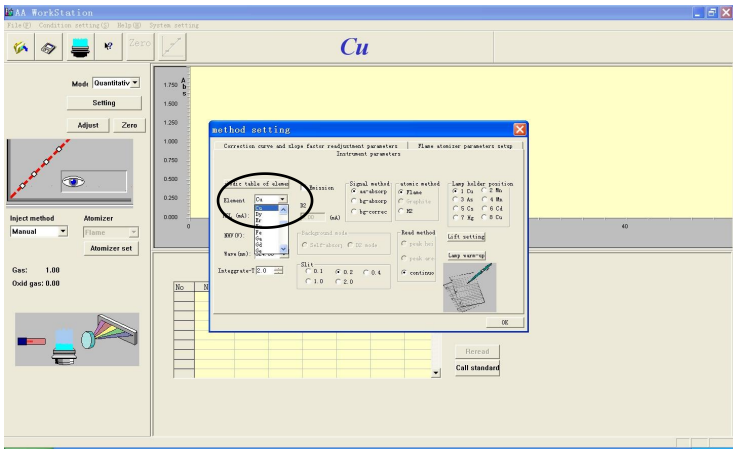


Figure 4-14

ATTENTION

Atomic absorption methods are not suitable for analysis of nonmetal elements. If no analysis conditions are available for a selected element, no analysis will be conducted.

5. Wavelength selection: The default wavelength is the main sensitive line of the selected element. If another sensitive line is necessary, move the cursor to the "Wavelength" pull-down list and select a wavelength by clicking on it, as shown in Figure 4-15.

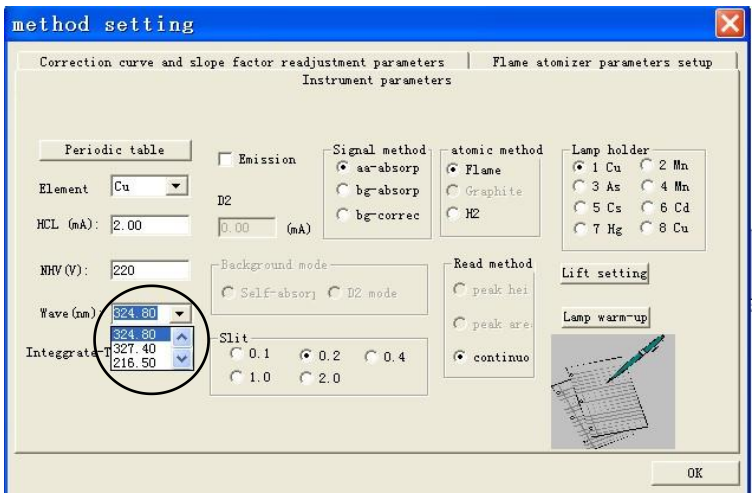


Figure 4-15

6. Negative high voltage selection: Enter the desired value into the "Negative high voltage" field. The range of negative high voltages is **0 – 700 V**, as shown in Figure 4-16.

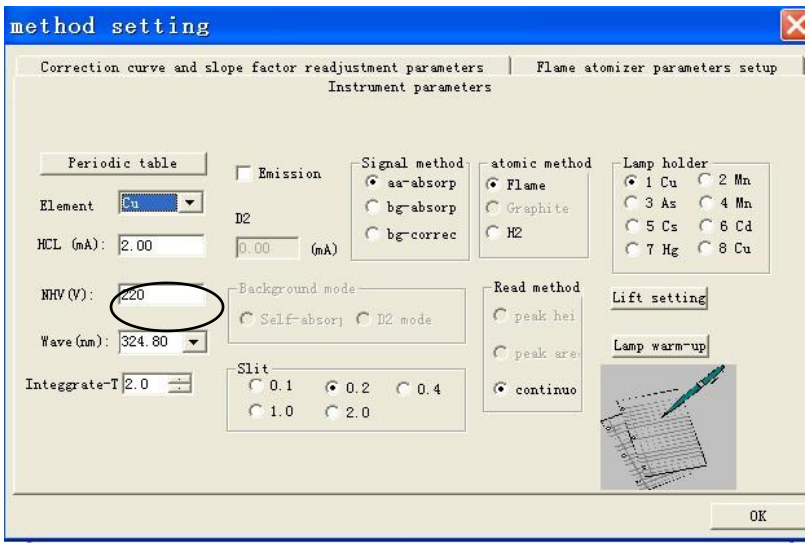


Figure 4-16

7. Lamp current selection: Enter the desired value into the "Lamp current" field. The range of lamp currents is **0 – 12mA.**See Figure 4-17.

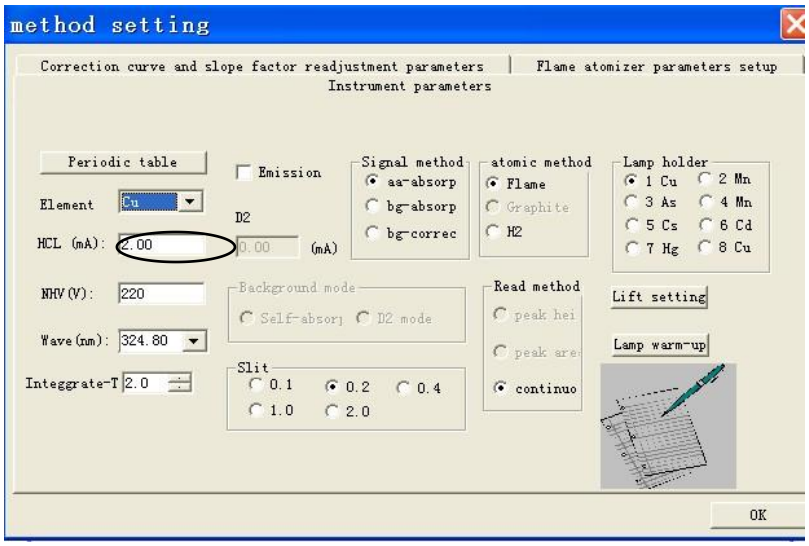


Figure 4-17

8. Signal types: Signals have three types, atomic absorption, background absorption, and background correction. Select any type of the radio boxes (The dot in the box indicates being selected), as shown in Figure 4-18.

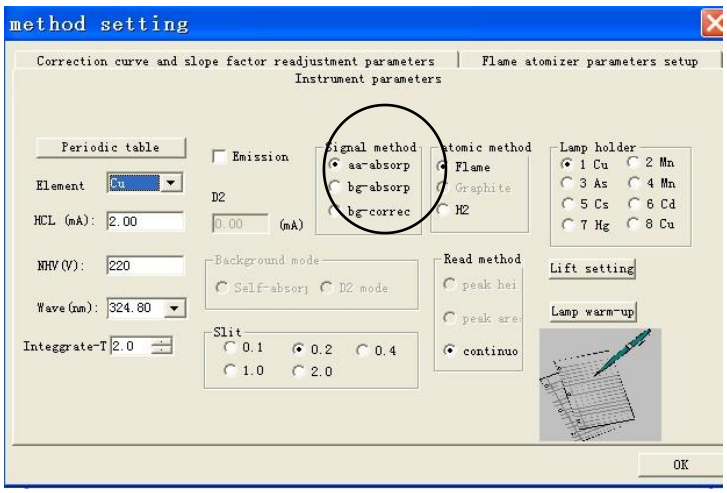


Figure 4-18

9. Display after selection of a signal type:

   a. After "Atomic absorption" is selected as shown in Figure 4-19, the field for deuterium lamp current is gray. The fields for background mode are also grey, and the radio boxes for emission are selectable (Selection of these boxes are optional).

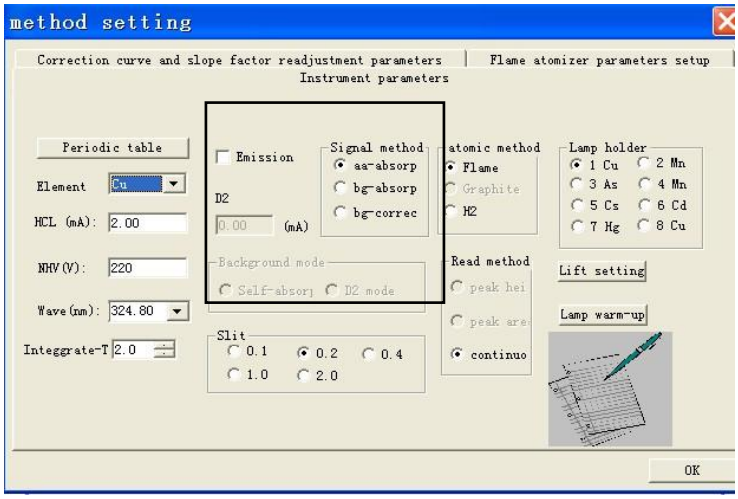


Figure 4-19

   b. After "Background correction" is selected as shown in Figure 4-20, the fields for the background mode and deuterium lamp current are enabled, while the radio boxes for emission are disabled.

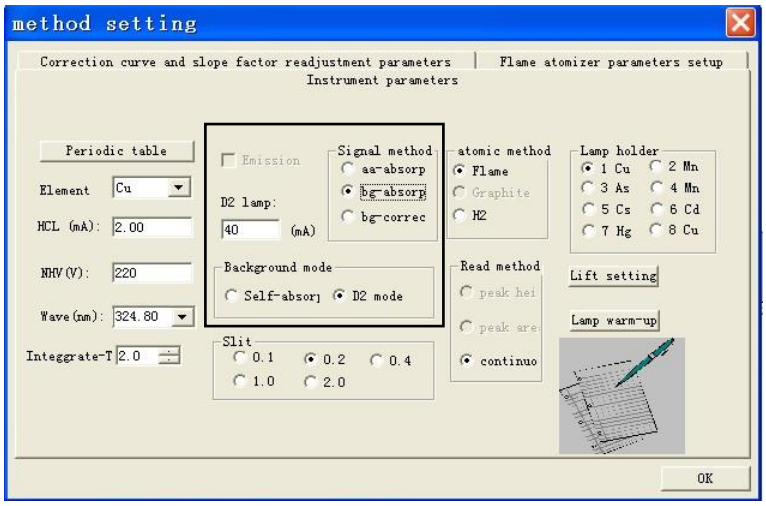


Figure 4-20

c. After "Background absorption" is selected as shown in Figure 4-20, the radio boxes for emission and the field for deuterium lamp current are enabled, while the self-absorption mode is disabled, as shown in Figure 4-21.

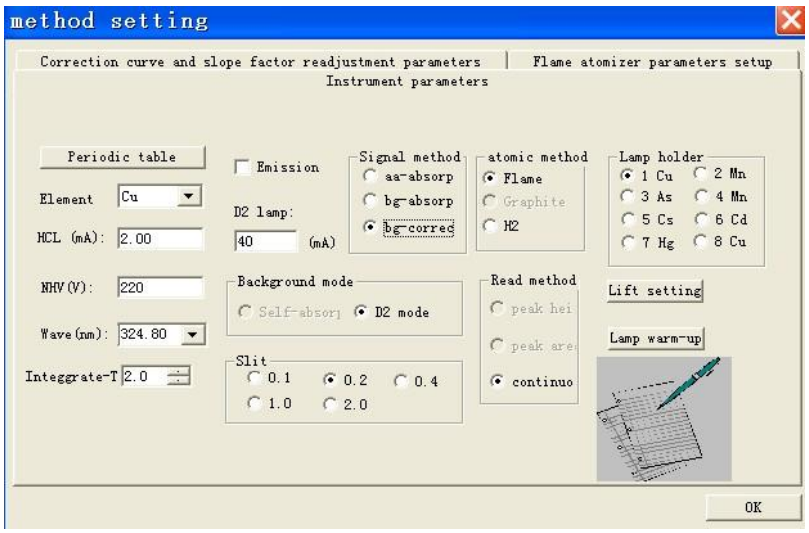


Figure 4-21

10. Deuterium lamp current: The deuterium lamp current varies in the following conditions:

    a. After "Atomic absorption" is selected, the field for deuterium lamp current is grey.

    b. After "Background correction" is selected, there are two possibilities:

1) If "Deuterium lamp" is selected for the background mode, just enter the current value in the field. The range of current is 12 – 110mA, as shown in Figure 4-22.

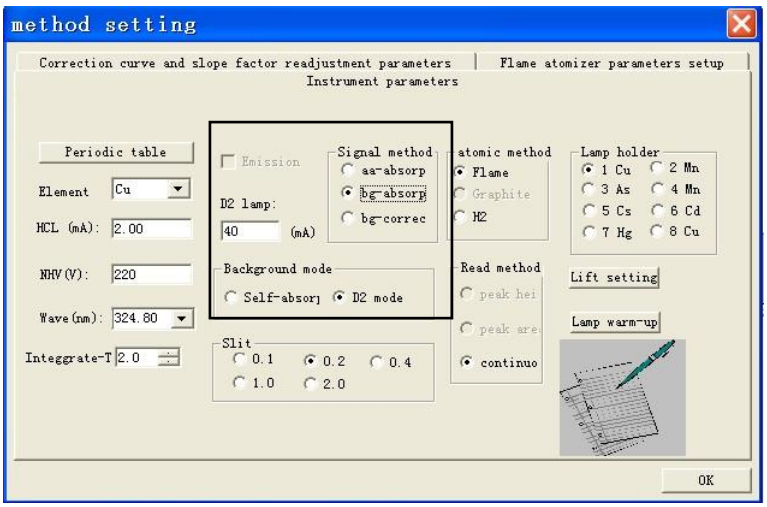


Figure 4-22

2) If "Self-absorption" is selected for the background mode, the "Deuterium lamp current" automatically changes into the "Self-absorption current" field. Just enter the desired current value into the field, as shown in Figure 4-23. The range of current is **0-14mA**.

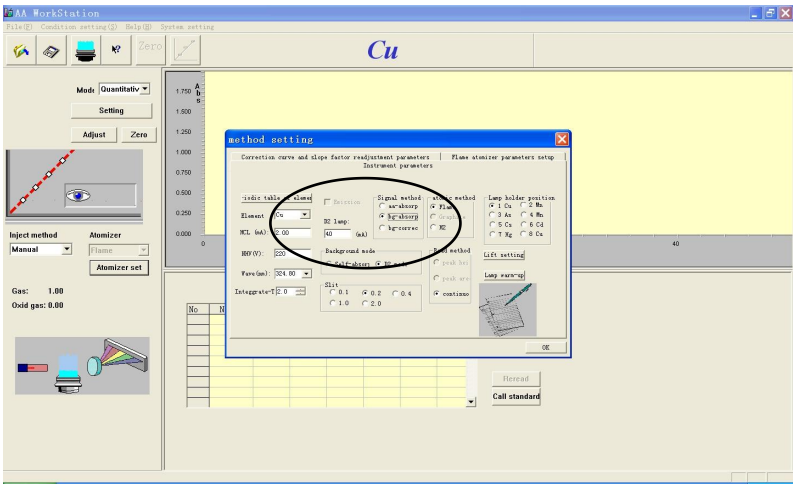


Figure 4-23

c. After "Background absorption" is selected for the signal type, the field for deuterium lamp current is enabled; and then enter the current value into the field.

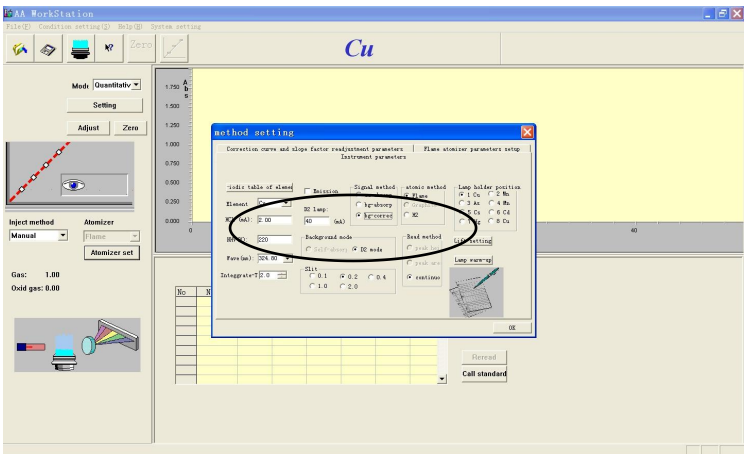


Figure 4-24

11. Slit: There are five radio boxes (0.1, 0.2, 0.4, 1.0 and 2.0) for the slit, and only one option can be selected.

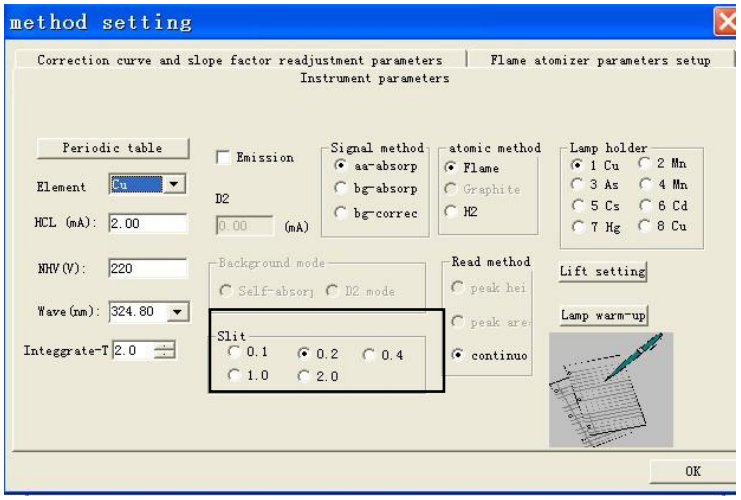


Figure 4-25

12. Lamp holder position: There are eight radio boxes (1, 2, 3, 4, 5, 6, 7 and 8) for the lamp holder position, and select one option for the position, as shown in Figure 4-26.

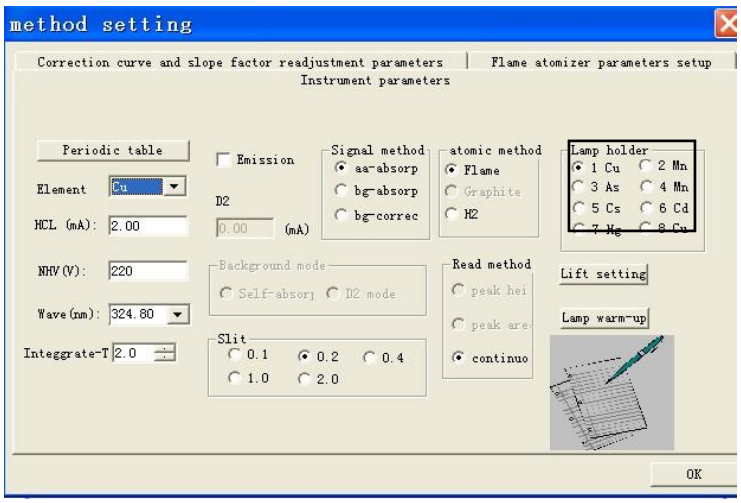


Figure 4-26

13. Press the "Lifting platform settings" button to display the "Lifting platform" dialog as shown in Figure 4-27. Press "◄", "►", "▲" and "▼" buttons or directly enter the coordinates to adjust the position of the lifting platform. The range of forward and backward movement is 0~250, and the range of upward and downward movement is 0~250.

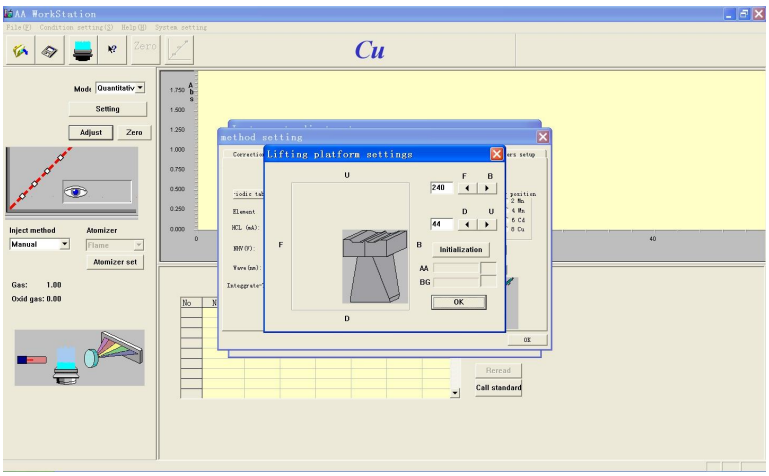


Figure 4-27

14. After startup, the instrument automatically makes the lifting platform stay at the previous position. Press the initialization button if necessary, and make further adjustment with the "◄", "►", "▲" and "▼" buttons as section 13.

15. If the instrument has a flame device, as shown in Figure 2-2, the "Flame" method is enabled. If the instrument has a graphite furnace, the "Graphite furnace" method is enabled. See Figure 4-28.

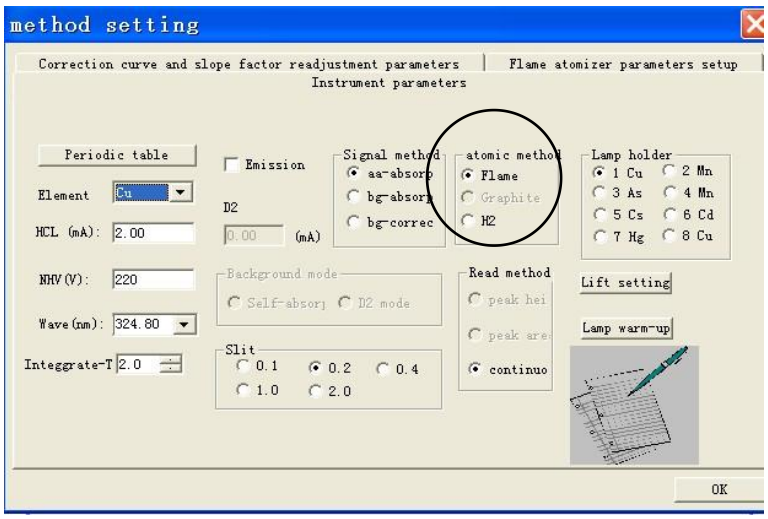


Figure 4-28

16. Reading types: Three types of readings are available, peak height, peak area and continuous type, as shown in Figure 4-29, which can be selected depending on different tests.

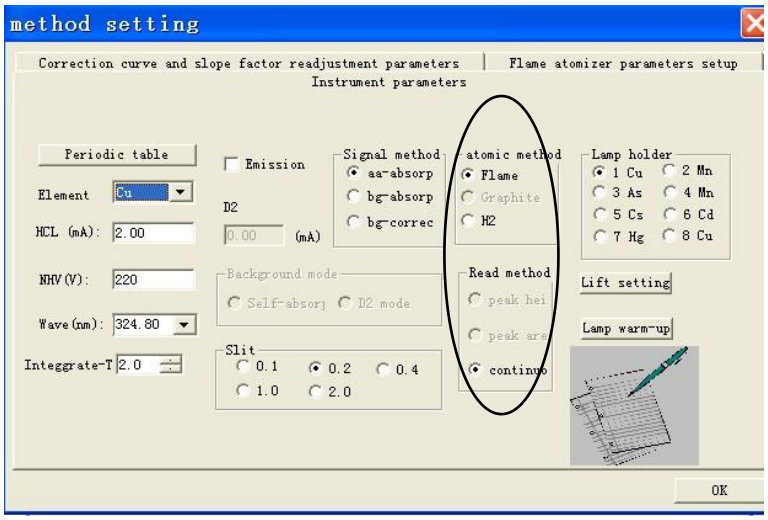


Figure 4-29

ATTENTION **Generally, if the flame method is applied, the "Continuous" reading type can be chosen.**

17. Press "Lamp warm-up", and the screen is as shown in Figure 4-30.Select one or multiple lamps for warming up.

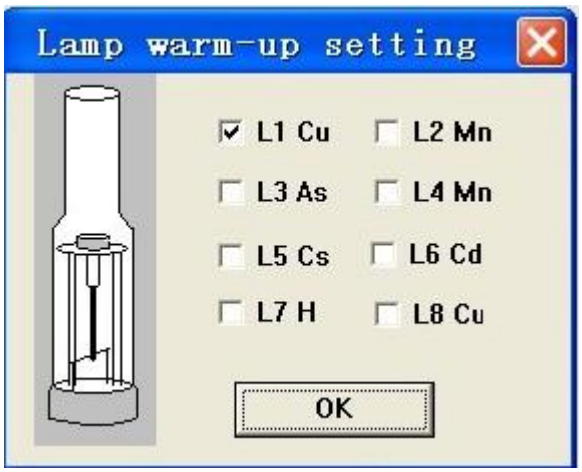


Figure 4-30

18. Save method: After above parameters have been set:

a. Select "Save method" in the "File" menu, as shown in Figure 4-31.

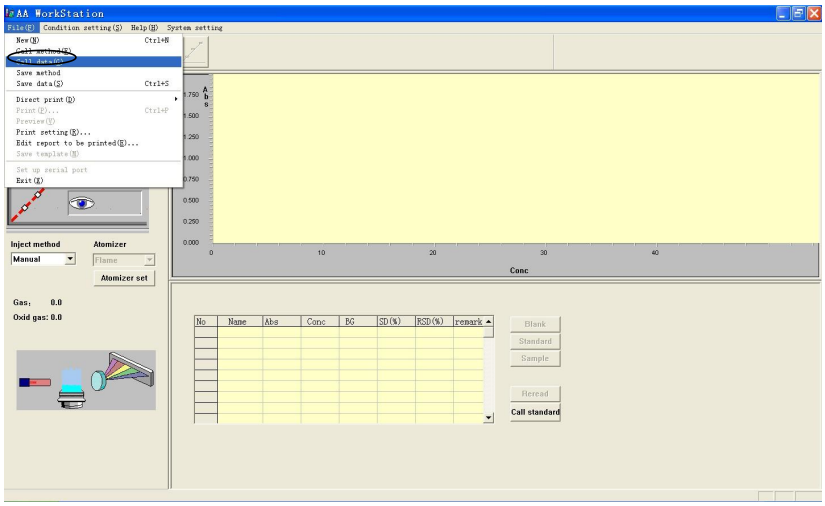


Figure 4-31

b. The "Display information" dialog will appear as shown in Figure 4-32. The dialog displays the instrument conditions you have set.

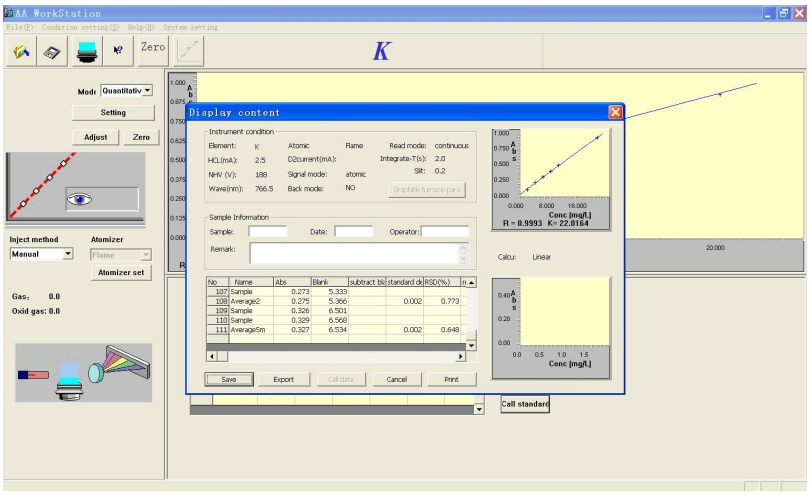


Figure 4-32

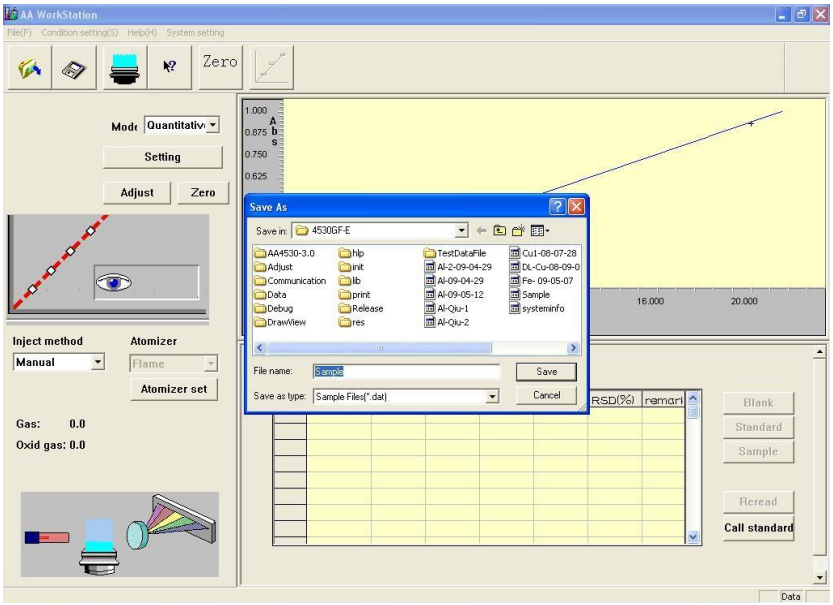


Figure 4-33

c. Press “Save” and the “Save as” dialog will appear as shown in Figure 4-33. Enter the file name and press “Save”.

19. Call criteria:

a. Press the "Call criteria" button, as shown in Figure 4-35.The "Open" dialog will appear as shown in Figure 4-35-1.

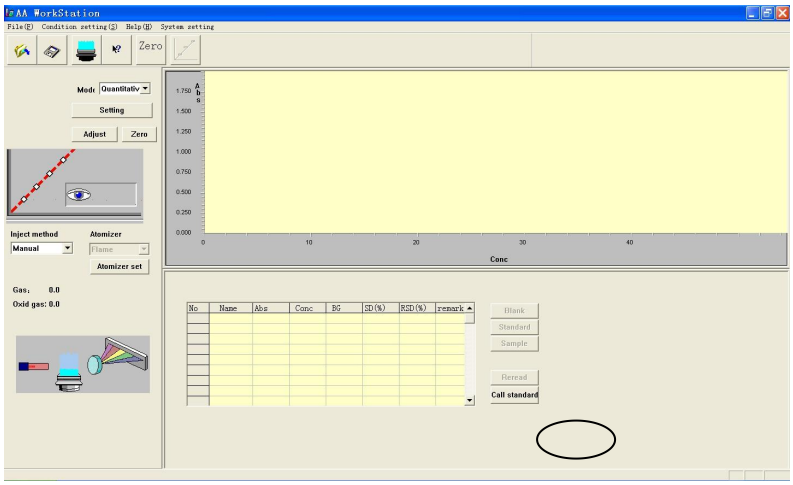


Figure 4-35

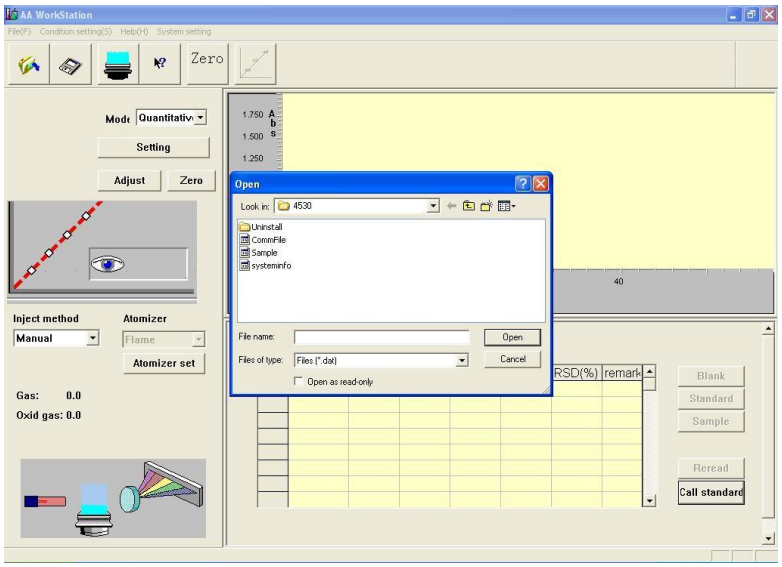


Figure 4-35-1

b. Select the file to be opened, and press "Open" to go to the "Display information" dialog. The dialog displays the saved standard sample. Press "OK" to enter the standard sample. See Figure 4-35-2.

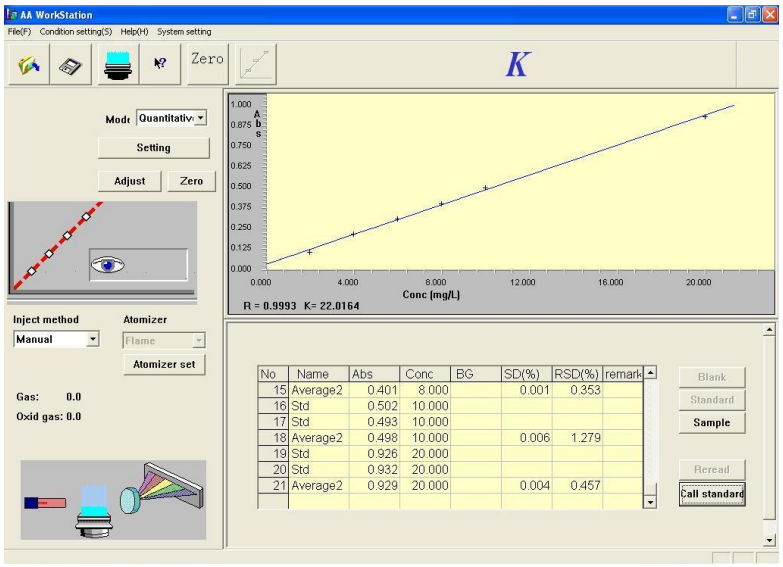


Figure 4-35-2

c. After the standard sample has been entered, you can start test samples.

Correction Curve and Slope Factor Readjustment Parameters

1. Equation selection: The pull-down list contains seven methods (linear method, curve correction, linear standard addition, curve standard addition, direct reading of absorbance, single-point method and standard deviation). Select the desired method from the list, as shown in Figure 4-36.

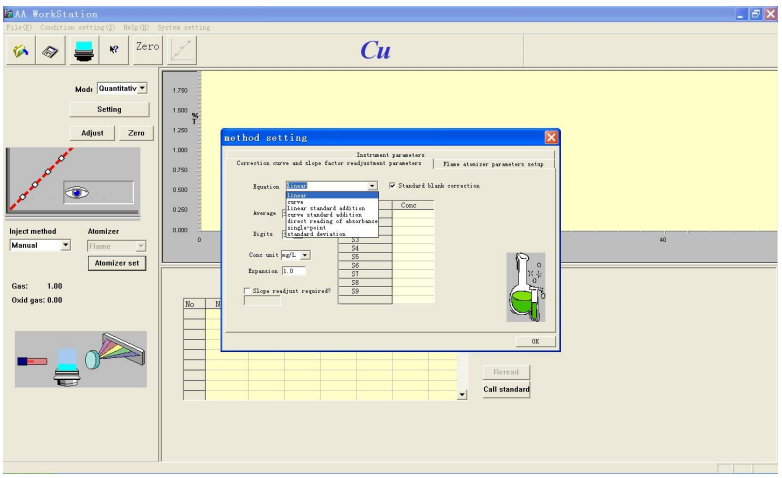


Figure 4-36

2. Average times: Enter a proper value within the range of 1-21. There are two methods for entering the average times. You may directly enter the value of average times. Alternatively, you can select the value by pressing the up and down arrow buttons.

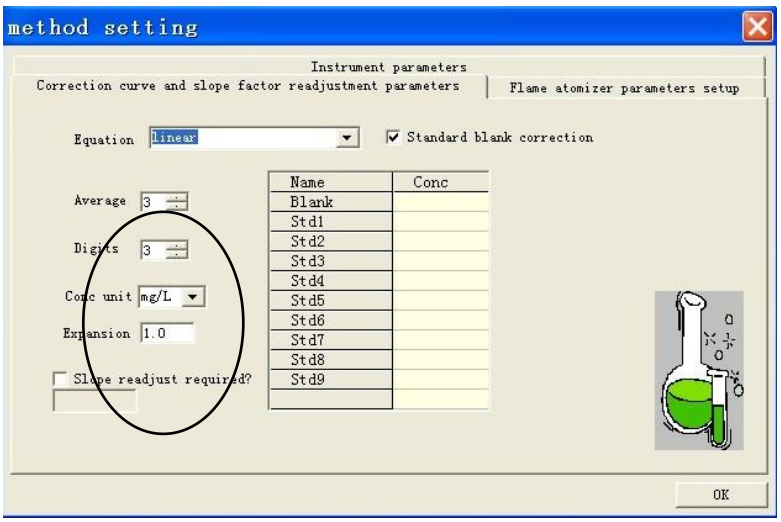


Figure 4-37

3. Significant digits: Enter a proper value within the range of 1-4, as shown in Figure 4-37. The methods for entering the value are similar to those for entering the average times.

4. Concentration unit: The default concentration unit is mg/L. Alternatively, press "▼" to select the desired unit, as shown in Figure 4-37.
5. Expansion: Enter the desired scale expansion times (0.1-30) in the field, as shown in Figure 4-37.

6. Whether slope factor readjustment is required: The setting is deselected by default. If slope factor readjustment is required, check the box, as shown in Figure 4-37.

7. Standard blank correction: The setting is deselected by default. If standard blank correction is required, check the box, as shown in Figure 4-37.

8. The concentration of standard samples must be entered in the table on the right for other test methods except direct reading of absorbance. The concentration of standard samples must be entered in the table on the right for other test methods except direct reading of absorbance (The concentration of 9 standard samples can be entered in maximum).The table for linear standard addition method and curve standard addition method is as shown in Figure 4-39 (The concentration of 8 standard samples can be entered in maximum).

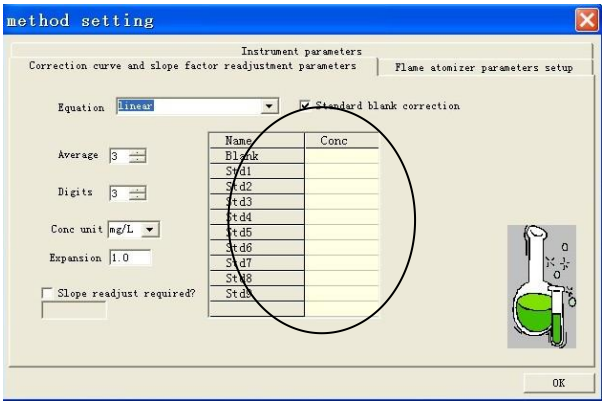


Figure 4-38

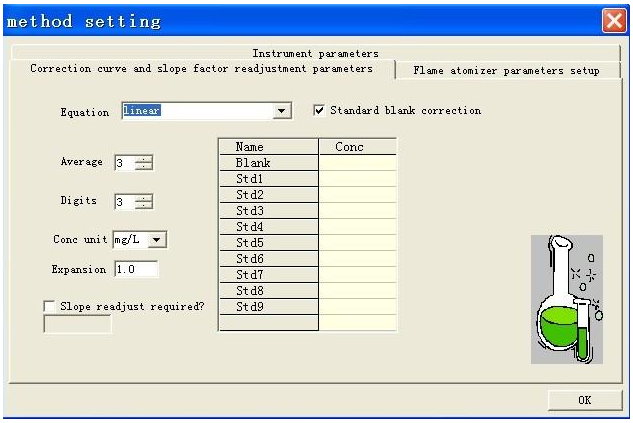


Figure 4-39

Flame Atomizer Parameter Setup

1. The screen of "Flame atomizer parameters" is as shown in Figure 4-40.

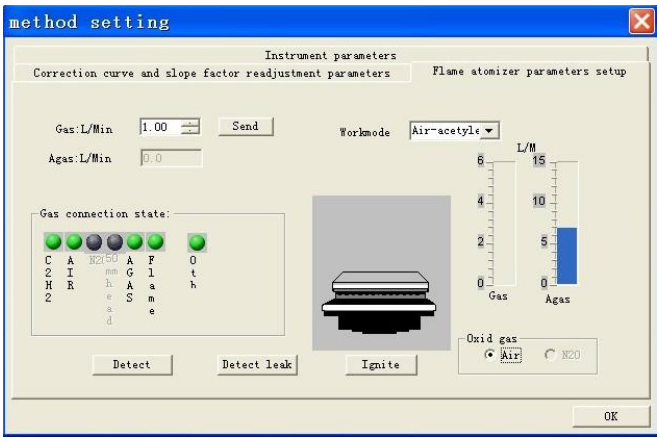


Figure 4-40

2. Enter a proper value within the range of 0-6 for the fuel gas.
3. Two modes are available, "Air-acetylene", as shown in Figure 4-41. The mode must be determined before ignition.

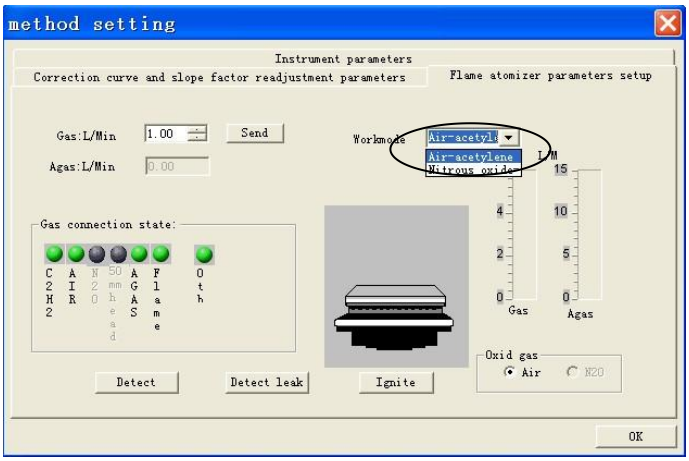


Figure 4-41

4. For gas connection state, the green indicators mean the normal state, and red indicators mean abnormality, as shown in Figure 4-41.A prompt dialog will appear if abnormality exists.
5. The "Detect" button is for detecting the flow rates of gases. Press "Detect" before ignition, and the gas flow rates will be shown (Attention: the flow rates shown for your instrument may be different from those shown in the figure).

6. Press "Detect leakage" to check the gas connection, as shown in Figure 4-42. After detection, press "Stop detection" to return to the screen as shown in Figure 4-41. See details in "Ignition Operation".

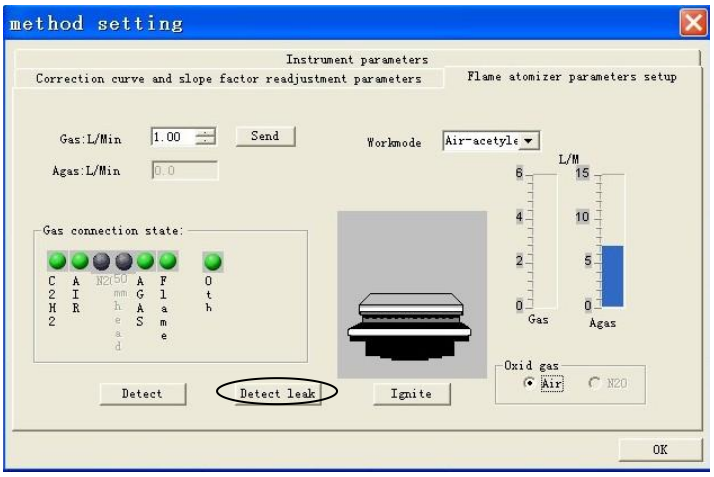


Figure 4-42

Light Source Correction

Take a copper lamp for example, and lamp 1 is the one currently being used.

1. Press "Instrument adjustment" to show a dialog as shown in Figure 4-43.

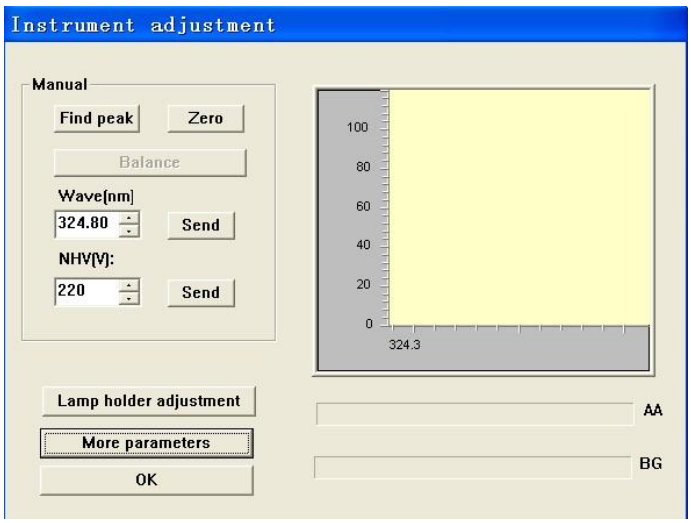


Figure 4-43

2. Press the "More parameters" button in the dialog to enter the "Instrument parameters" screen. For example, an element Cu is selected; the wavelength is 324.8 nm; the negative high voltage is 200 V; the current is 2.0 mA; and the slit is 0.2 nm. See Figure 4-43a.

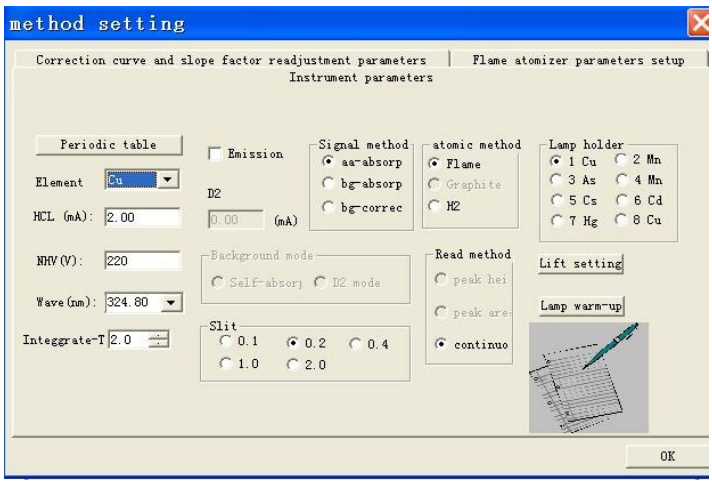


Figure 4-43a

3. Press “OK”, and the screen is as shown in Figure 4-44. Press “Find peak” for automatically finding the center of the wavelength.

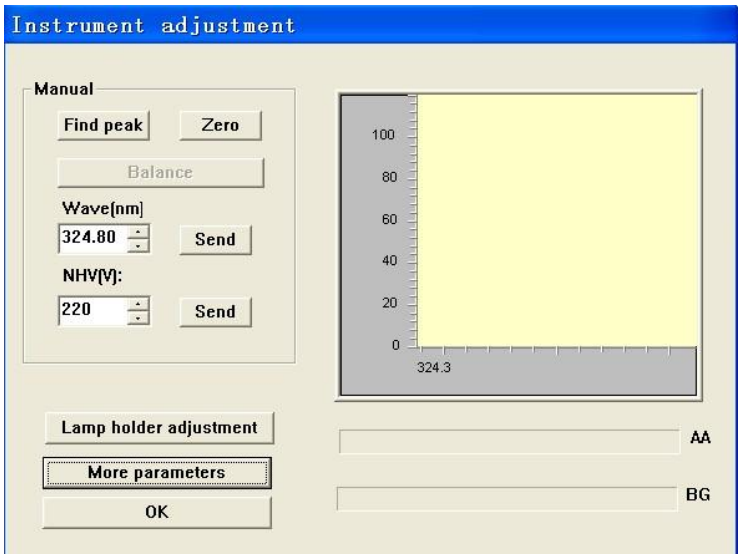
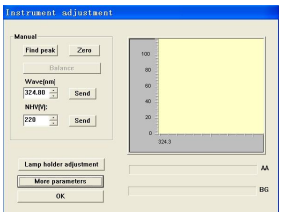
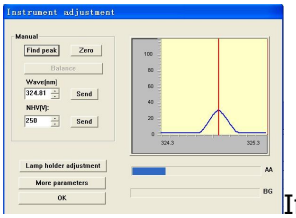


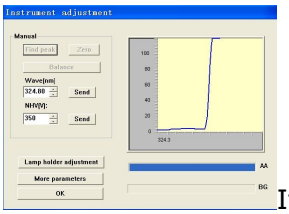
Figure 4-44

If the energy indication is close to zero, increase the lamp current and the negative high voltage, or press “Lamp holder adjustment” to adjust the position of the lamp holder.

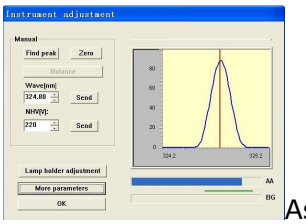




If the energy indication is not within the green zone, press “Zero” or increase the negative high voltage, for the energy indication to fall within the green zone.



If the energy indication outflows, decrease the negative high voltage to re-find the peak until the energy indication to fall within the green zone, and the peak is the optimal absorption peak of the element.



As shown in the figure on the left, the energy indication is in an optimal state.

4. The light source correction is completed.

Ignition Operation

Burner Position Adjustment

The route and position of the light beam from the hollow cathode lamp in the flame can significantly affect the sensitivity of the system. The slit of the burner should be parallel to and slightly lower than the optical axis of the instrument. Detailed steps are given below:

1. Press "Instrument adjustment" to show a dialog as shown in Figure 4-45.

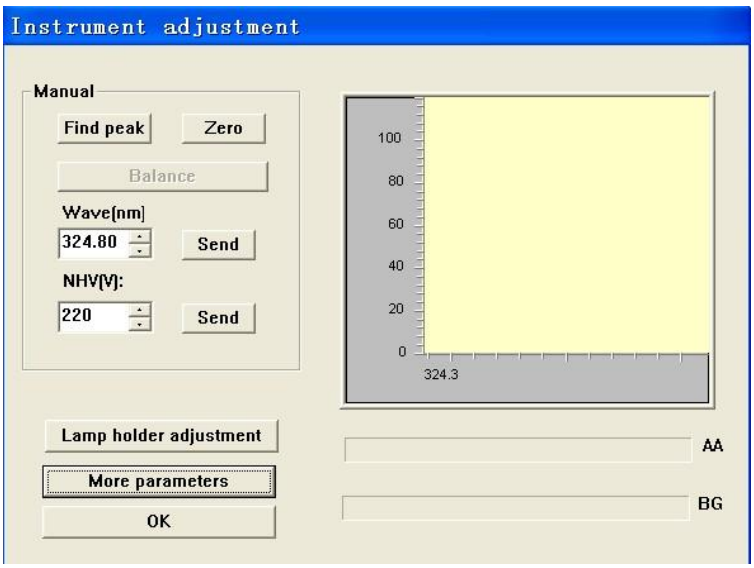


Figure 4-45

2. Press "More parameters" to show a dialog as shown in Figure 4-46.

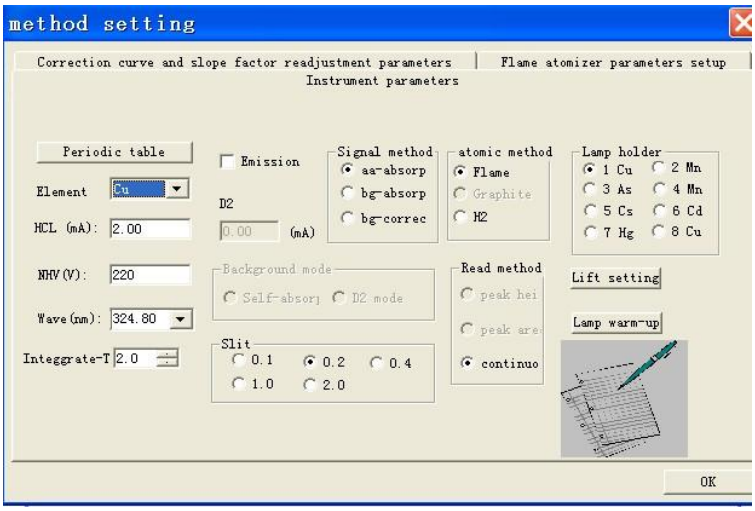


Figure 4-46

3. If you need to adjust the position of the lifting platform, press the "Lifting platform settings" button to display the "Lifting platform" dialog as shown in Figure 4-47.

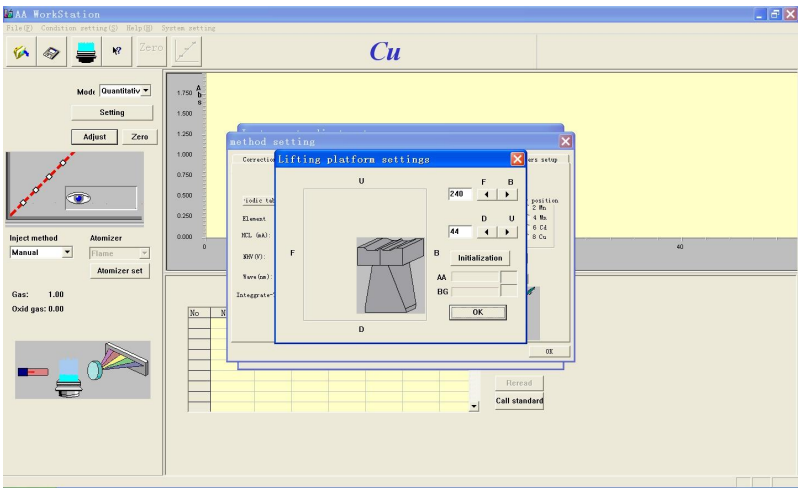


Figure 4-47

4. Make further adjustment with the "◄", "►", "▲" and "▼" buttons (After startup, the instrument automatically makes the lifting platform stay at the previous position).

5. Operation: Place the light check board on the slit of the burner; you may press "◄", "►", "▲" and "▼" buttons to adjust the burner (The range of forward and backward movement is 0~250, and the range of upward and downward movement is 0~250) to align the light spot center with the center line of the light check board; the light spot center should be at about 5 mm on the light check board.(This data varies for different elements)

Ignition

PRECAUTIONS **CHECK WHETHER THE WATER SEAL EXIST IN THE DRAIN PIPE BEFORE EACH TIME OF IGNITION!**

Connect the gas pipes as shown in Figure 4-48.

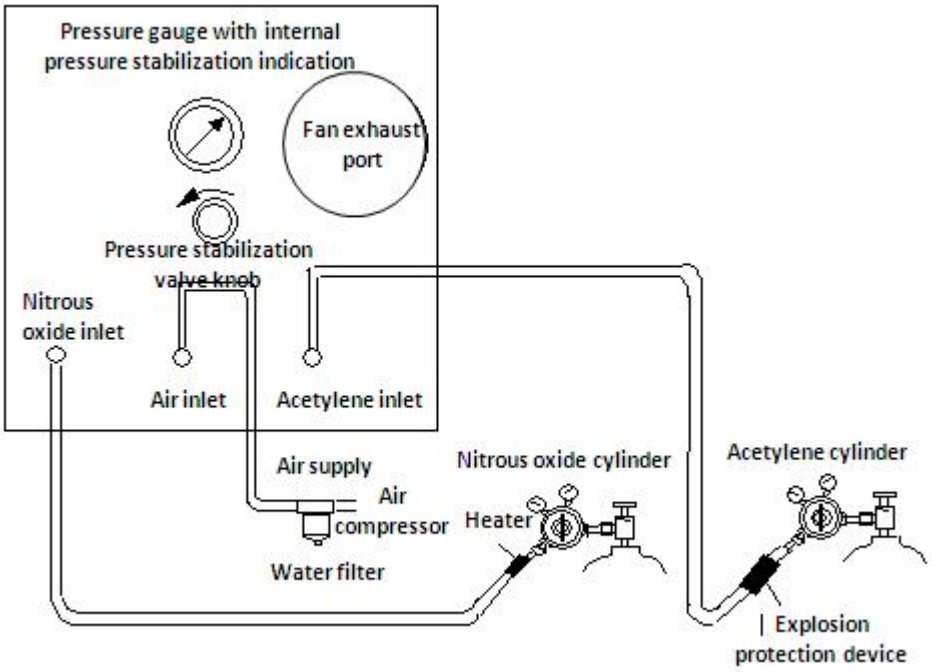
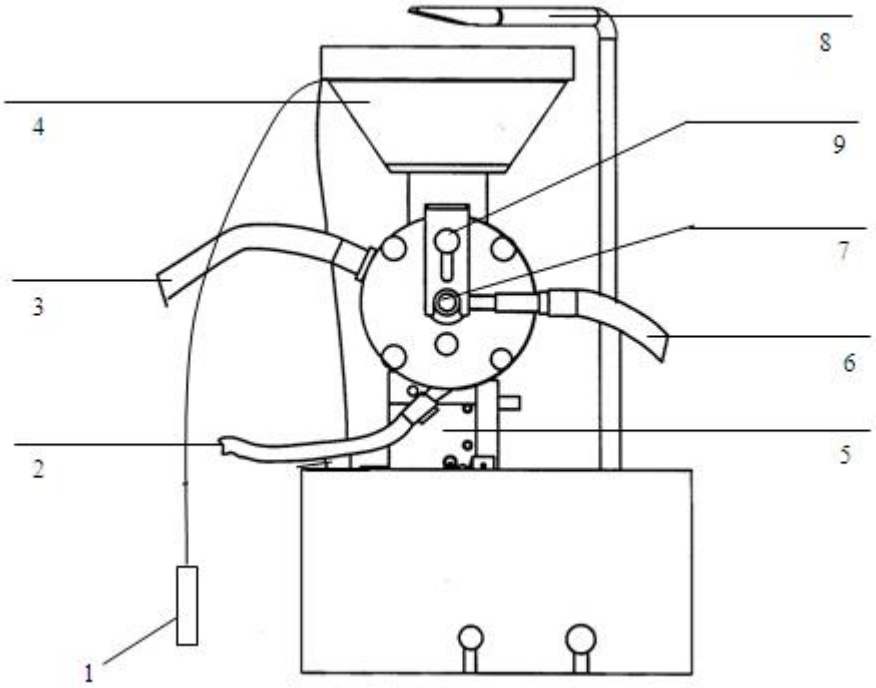


Figure 4-48

Check Gas Connection

The entire gas connection must be inspected before ignition during installation and testing, to avoid gas leakage. Periodically inspect the gas connection thereafter. See Figure 4-49.



1. Safety interlock bolt and detection head	2. Drain pipe	3. Mixed gas pipe
4. Burner (50 mm or 100 mm)	5. Automatic lifting platform	6. Expanded gas pipe
7. Nebulizer	8. Igniter	9. Pressing disc

Figure 4-49

Inspection Procedures:

1. Connect the pipes by referring to Figure 4-19 for the gas connection diagram. Turn on the acetylene pressure reducing valve until the output pressure is adjusted to be 0.1MPa. Turn off the acetylene pressure reducing valve.
2. Rotate off the two gas pipe connectors in the combustion chamber from the premix chamber (item 3 and 6 shown in Figure 4-49), and connect them with a connector. Rotate them tight.

3. Turn on the air compressor, and adjust the output pressure to be 0.3MPa. Adjust the internal stabilization pressure of the pressure stabilization valve to be 0.2MPa within the instrument. Turn on the power of the gas connection. Turn on the needle valve of acetylene. Pressure the "Detect leakage" button and turn off the pressure stabilization valve tight. It is required that the internal pressure of the instrument should be decreased to below 0.02 Pa; otherwise, there is leakage in the gas connection.

PRECAUTIONS **DO NOT WORK WITH GAS CONNECTION WITH LEAKAGE, OTHERWISE SAFETY ACCIDENTS MAY OCCUR.**

Air-Acetylene Ignition

1. Turn on the air compressor, and adjust the pressure to be 0.3MPa. Turn on the acetylene cylinder, and the output of the pressure reducing valve should not exceed 0.1MPa.
2. As shown in Figure 4-50a, press the "Atomizer settings" to enter the "Flame atomizer parameters" screen. See Figure 4-50b.

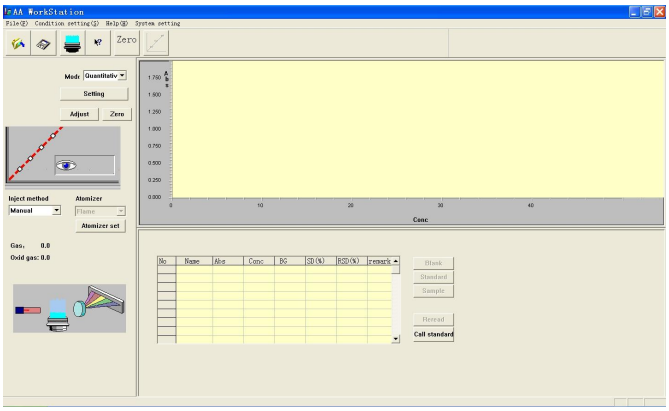


Figure 4-50a

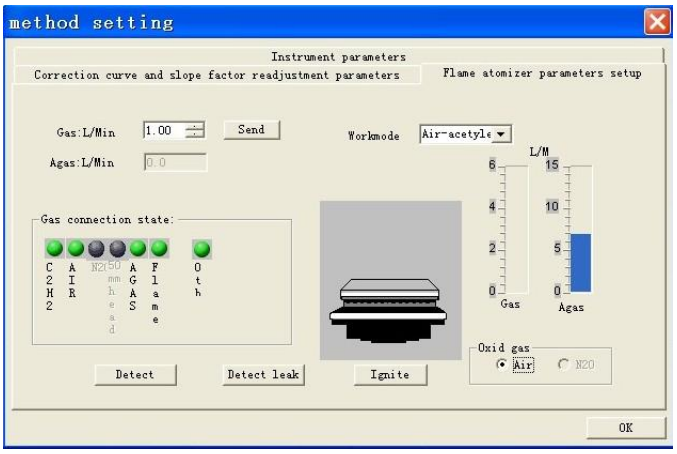


Figure 4–50b

3. Enter a proper value in the "Fuel gas" field, or move the cursor onto the arrows. Press the up arrow to increase the value (larger flow rate), or press the down arrow to decrease the value (lower flow rate). Press the "Ignite" button until the flame appears. When a flame is just ignited, the flame is high. See Figure 4-50c.The flame will reach the normal state after a few minutes. See Figure 4-50d.

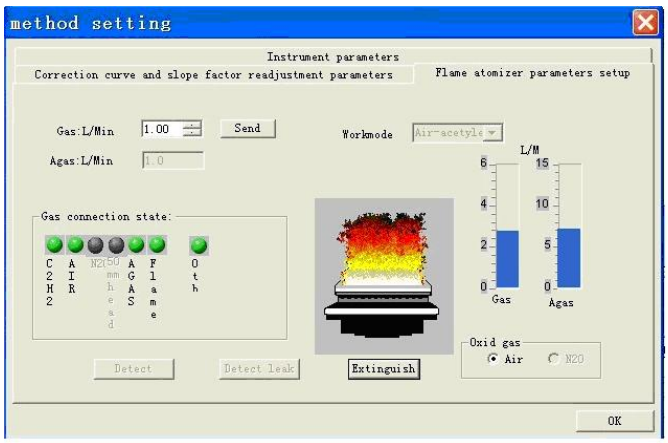


Figure 4-50c

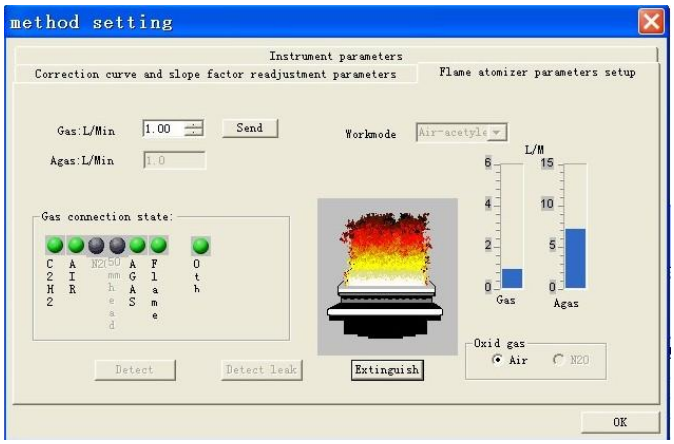


Figure 4-50d

4. If ignition fails after the “Ignite” button is pressed. You may appropriately increase the flow of acetylene.
5. After the flame is ignited and retain stable, you may change the flow of acetylene at any time.
6. Press “OK” to close the dialog.

Flame Adjustment

After the flame is ignited, the proportions of the fuel gas and the combustion-supporting gas can changed by adjusting the flow rates of the gases (In the air-acetylene mode, the fuel-lean flame gives off blue light with high temperatures, and the fuel-rich flame gives off yellow light with low temperatures).The nitrous – acetylene flame should have a red lampwick of 1-2 cm. The state of flame should be adjusted based on actual requirements on the test elements.

AA Flame Extinguishing

1. After the analysis activities have been completed, spray deionized water for cleaning. If an organic solvent is used, also clean the burner after the flame is extinguished.
2. Turn off the master switch of the acetylene cylinder and the pressure reducing valve. Only turn off the air compressor after the flame is extinguished. In the case of a nitrous flame, it is recommended to press the "Atomizer settings" to enter the "Flame atomizer parameters" screen, select the "Air-acetylene" mode, and select "Extinguish".
3. If the instrument is to be left unused for a period of time, turn off the sources of air, acetylene, etc, and press the "Inspect" button to allow the residual gases in pipes are empted.

ATTENTION

If an error prompt is shown during or after ignition, please immediately extinguish the flame and contact our After-Sale Service.

Cleaning of Burner Slit

When the burner is burning, an even flame should exist along the entire slit. If the flame is uneven or even saw-toothed, it indicates that the burner has accumulated carbon which should be cleared. In such case, extinguish the flame, and fold a piece of filter paper and insert it into the slit. Repeatedly and slightly clean the interior sides of the slit until the accumulated carbon has been removed.

If the abovementioned cleaning method is ineffective, remove the burner for cleaning according to the following steps:

1. Pull out the bolt of the burner from the bottom plate of the combustion chamber, and pull the burner off the premix chamber.
2. Remove the four screws on the burner base to separate the top side boards of the burner from the base. Then, remove the bolts fixed on the side boards of the burner (Remember the position of the bolts).
3. Remove the two screws on the sides of each side board (Remember the position of the gaskets on both sides).
4. Immerse the two side boards and the burner base in 5% dilute nitric acid for 30 minutes. Take them out and wash them with tap water. Wash them with deionized water for several times.
5. Place a piece of metallographic sand paper on a glass table surface. Place the burning surfaces (i.e. the slit surfaces of the burner) of the side boards on the sand paper, and sand them lightly to make the surfaces smooth and free of accumulated carbon. Then, wash the sanded side boards with deionized water.
6. Dip a piece of gauze into ethanol and use it to clean the 6 screws and 2 gaskets.
7. Reassemble the parts to their positions (Attention: The side boards and base of the burner must be tightly and evenly fixed without fissure; otherwise the flame may jump from the fissure after ignition).

ATTENTION

To avoid/reduce carbon accumulation at the burner when samples are made, place the sample suction tubes in distilled water and cook them for 20 minutes before extinguishing the flame.

Cleaning of Burner

Suction and Spraying of Organic Samples

After suction and spraying of organic agents (such as oils and isopropyl acetone), absorbance signals may start to have noise and become unstable. To avoid contaminated water solutions after suction and spraying of organic agents, completely clean the atomization system according to the following steps.

1. Suck and spray a blank organic agent for about 5 minutes.
2. Suck and spray acetone for 5 minutes.
3. Suck and spray 1% HNO3 for 5 minutes.
4. Inspect the burner. If there are deposits, remove the burner and clean it with a cleaning solution and a brush.
5. Use water to flush the drain pipe. Dispose of the waste liquid according to local regulations.

Suction and Spraying of High-Concentration Copper, Silver or Mercury Salts

PRECAUTIONS

AFTER SUCTION AND SPRAYING OF HIGH-CONCENTRATION COPPER, SILVER OR MERCURY SALTS, UNSTABLE ACETYLIDES MAY BE GENERATED AND PRONE TO EXPLOSION WHEN BEING DRY. THEREFORE, EACH TIME AFTER SUCH ANALYSES, SPRAY PURE WATER ON A TIMELY BASIS, COMPLETELY CLEAN THE PREMIX CHAMBER AND DRAIN PIPE, AND VISUALLY CHECK WHETHER RESIDUAL SUBSTANCES HAVE BEEN WASHED OFF FROM THE PREMIX CHAMBER.

Cleaning of Nebulizer and Sample Inlet Capillary Pipe

If absorbance readings remain low after the burner and burner slit have been cleaned, this may be caused by obstruction in the nebulizer or the sample inlet capillary pipe. Suck and spray a pure solution for burning until satisfactory readings are obtained for subsequent standard samples.

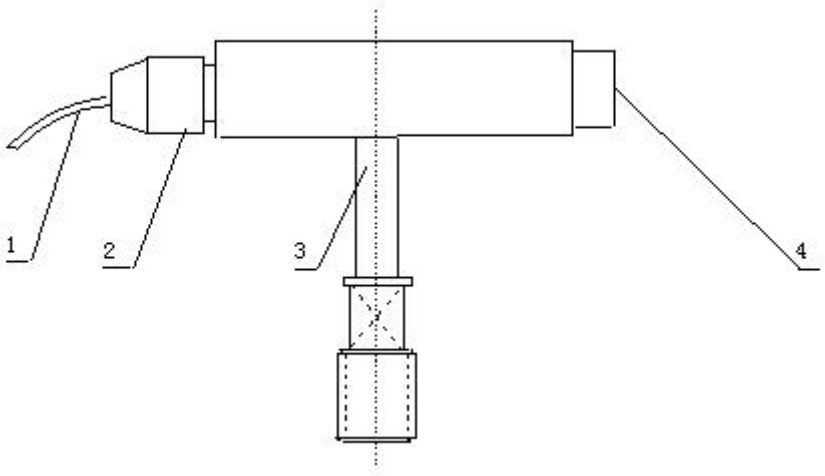
ATTENTION

If a long sample inlet capillary pipe is used, the suction and spraying flow and sensitivity of samples will be decreased. If the obstruction cannot be cleared through suction and spraying of the solution, it is necessary to clean the sample inlet capillary pipe.

1. Stainless steel nebulizer

   Use a φ0.3-mm wire to clear solid particles from the capillary pipe. If this method fails, remove and wash the nebulizer. The construction of the nebulizer is shown in Figure 4-51a.

   Generally, adjusting nut 2 has been properly set before shipment. No untrained operator is expected to adjust the nut or remove it, to avoid damaging the capillary pipe.

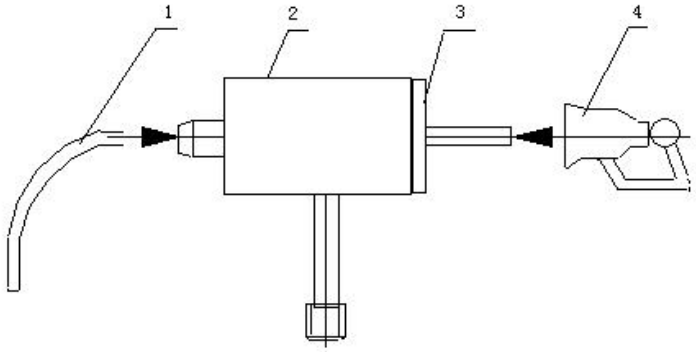


1. Sample inlet capillary pipe
2. Adjusting nut
3. Connector
4. Nozzle

Figure 4-51a Stainless Steel Nebulizer

2. Glass nebulizer

1. Unfasten the screw of the pressing disc and lift up the disc. Carefully take out the glass nebulizer and hold it on your hand. Turn on the switch of the air compressor. Insert the sample inlet capillary pipe (1) into deionized water, and rotate the dispersion ball (4) (Figure 4-51b), to realize the best spraying state.
2. If there are foreign substances in the capillary pipe, use a similar method. Carefully take off the dispersion ball (4) on the nebulizer. Turn on the switch of the air compressor. Insert the sample inlet capillary pipe (1) into deionized water. Use a figure to cover the outlet of the nebulizer for several minutes and swiftly move away the finger, until all foreign substances have been blew out of the capillary pipe.



1. Sample inlet capillary pipe 2. housing
3. O ring 4. Dispersion ball

Figure 4-51b Glass Steel Nebulizer

5

Quantitative Analysis

Direct Reading of Absorbance

Take a Cu lamp for example, and lamp 1 is the one currently being used.

Direct reading is only used for determining absorbance of samples under certain conditions. If it is necessary to know the concentration of an element in the sample, you must use another linear or curve or single-point quantitative analysis correction method.

1. For light source correction, see "**Light source correction**".
2. For igniting the flame, see "**Ignition operation**".
3. Enter a proper value in the "Integration time" field and select a proper reading method in the "Instrument parameters" screen, as shown in Figure 5-1a.

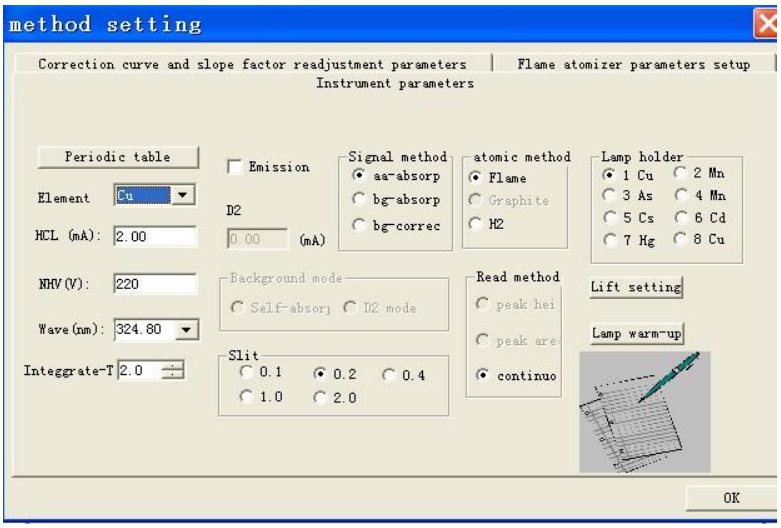


Figure 5-1a

4. As shown in Figure 5-1b, select "Quantitative analysis" in the pull-down list.

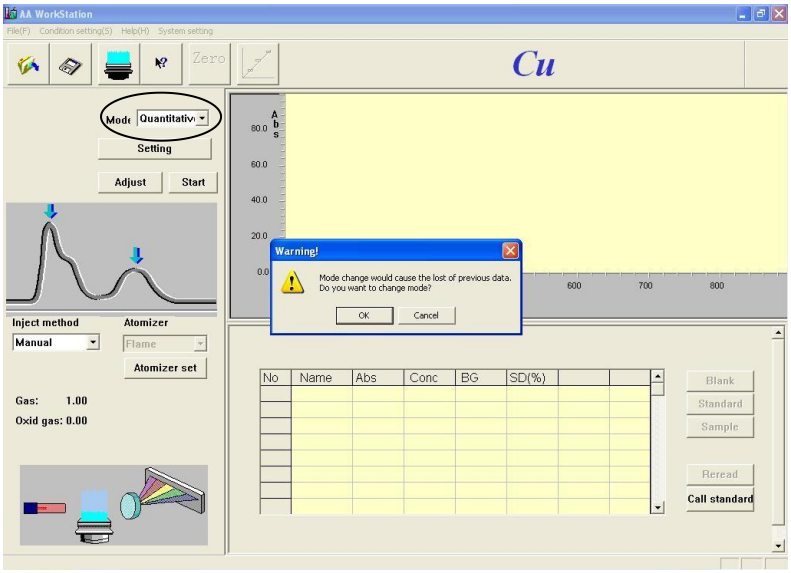

AA WorkStation
File(F) Condition setting(S) Help(H) System setting
Zero
Cu
Mode
Quantitativ
Setting
Adjust
Start
Inject method
Manual
Atomizer
Flame
Atomizer set
Gas: 1.00
Oxid gas: 0.00
Abs
80.0
60.0
40.0
20.0
0.0
600
700
800
Warning!
Mode change would cause the lost of previous data.
Do you want to change mode?
OK
Cancel
No
Name
Abs
Conc
BG
SD(%)
Blank
Standard
Sample
Reread
Call standard

Figure 5-1b

5. Press "OK" to confirm that you are about to conduct quantitative analysis.
6. Press "Setting" to enter the "Correction curve and slope factor readjustment parameters" screen, as shown in Figure 5-2.

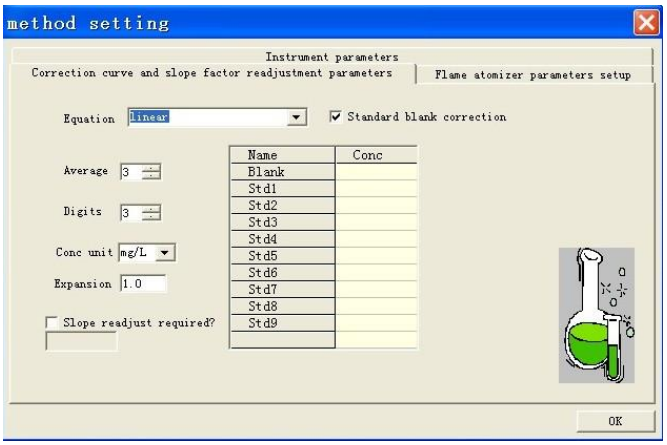


Figure 5-2

7. Select "Direct reading of absorbance" in the "Equation selection" pull-down list. Determine the conditions based on the actual needs. See Figure 5-3.

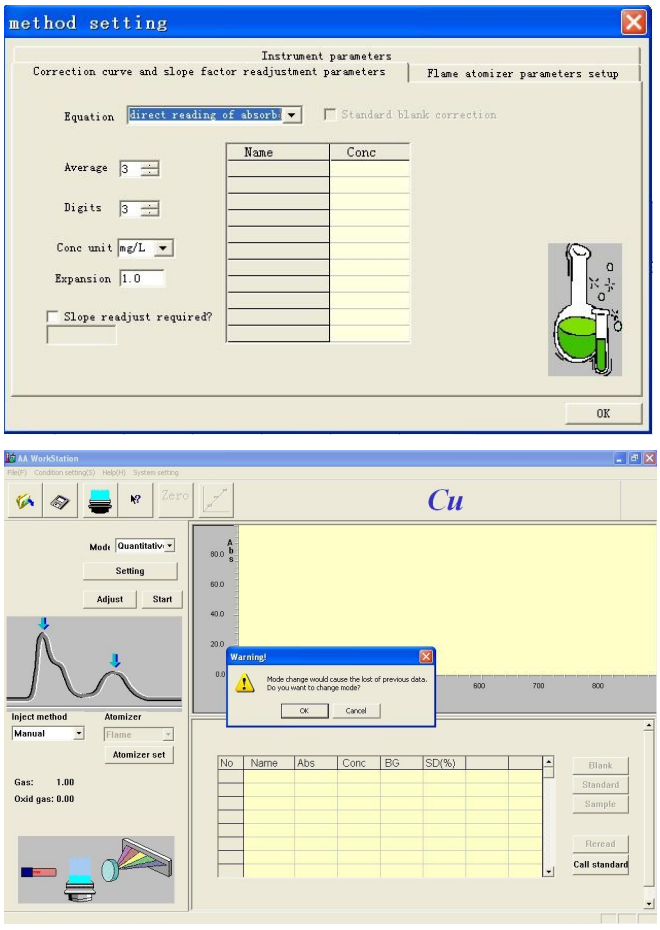


Figure 5-3

8. Press “OK” to close the dialog. Then the “Test sample” button is enabled.(See Figure 5-4)

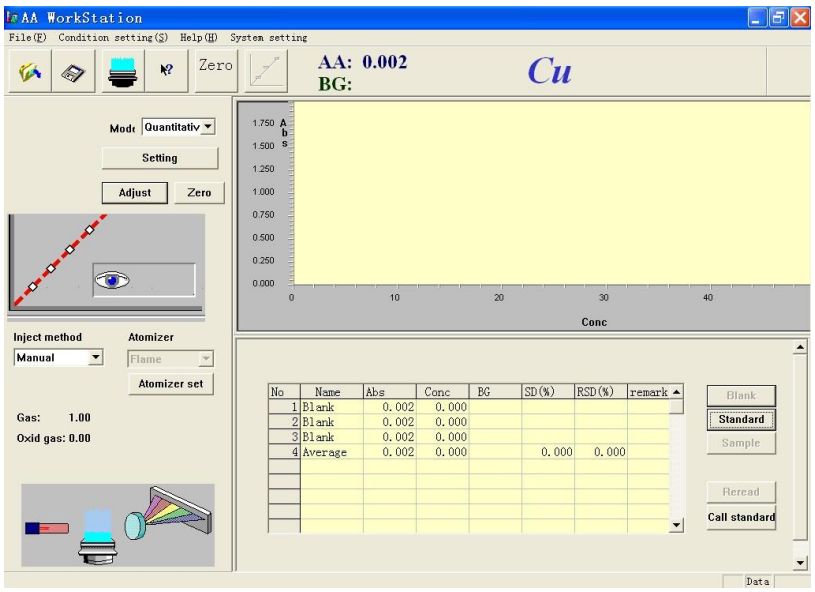


Figure 5-4

9. Press “Zero” to zero the instrument. After zeroing, suck and spray the sample. After the real-time displayed values become stable, press the “Test sample” button and the screen is as shown in Figure 5-5 (Because the “Average times” in the “Correction curve and slope factor readjustment parameters” screen is set to be 3, the values will be read for three times).

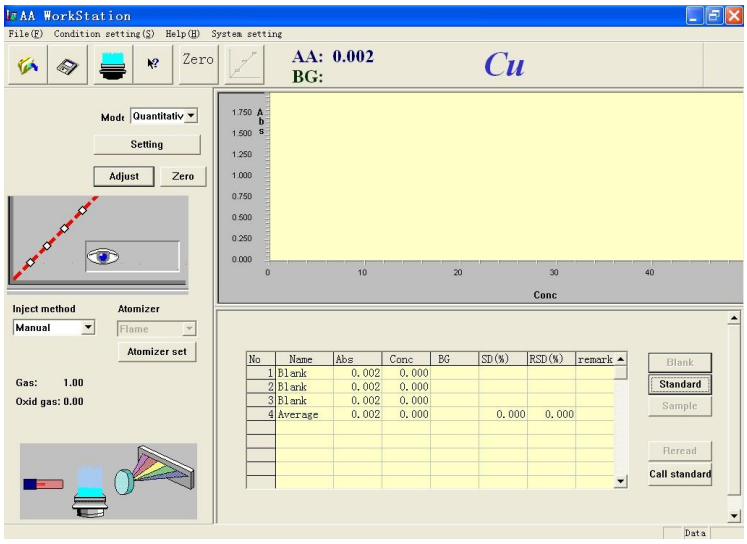


Figure 5-5

10. At this time, you may start sample insertion for the second time. Press "Test sample" again to start the second round of sample testing.
11. You may conduct multiple rounds of sample testing based on your actual needs.
12. If you are not satisfied with the test results, you may restart the testing. See "**Standard Sample Rereading and Deletion, and Name Modification**" for information of the method.
13. After sample testing is completed, you can save and print the test data.

Linear Method

The linear method is the most common quantitative analysis standard curve method and is suitable for quantitative analysis of elements whose standard curves have good linearity.

Take a Cu lamp for example, and lamp 1 is the one currently being used.

1. For light source correction, see "**Light source correction**".
2. For igniting the flame, see "**Ignition operation**".
3. Enter a proper value in the "Integration time" field and select a proper reading method in the "Instrument parameters" screen, as shown in Figure 5-6.

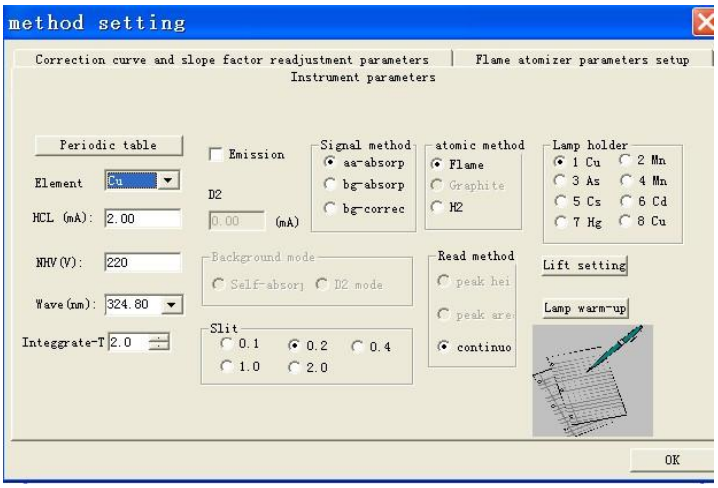


Figure 5-6

4. As shown in Figure 5-7, select "Quantitative analysis" in the pull-down list. Press "OK" to confirm that you are about to conduct quantitative analysis.

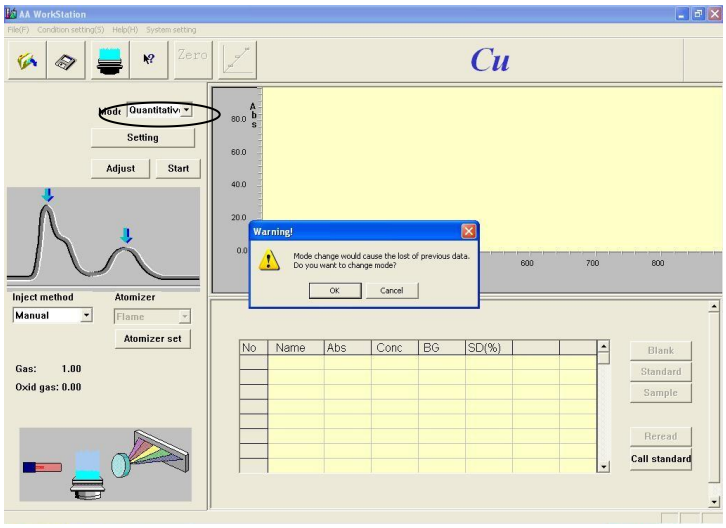


Figure 5-7

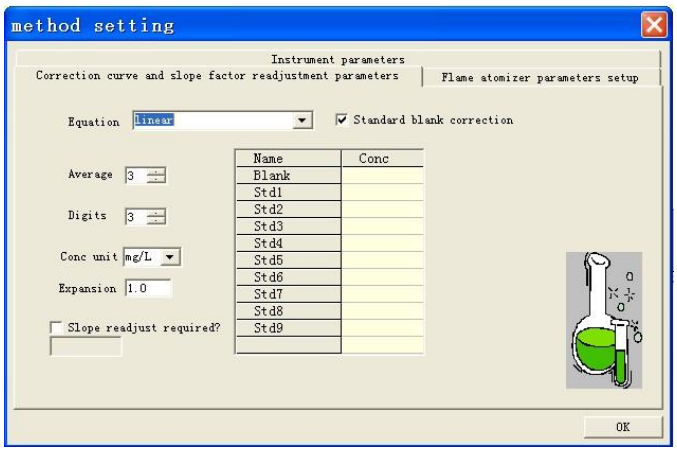


Figure 5-8

5. Press "OK" to confirm the quantitative analysis mode. Press "Setting" to enter the "Correction curve and slope factor readjustment parameters" screen, as shown in Figure 5-8.

6. Select "Linear method" in the "Equation selection" pull-down list. Determine the conditions based on the actual needs. See Figure 5-9. (Attention: At least 2 standard sample points should be entered.)

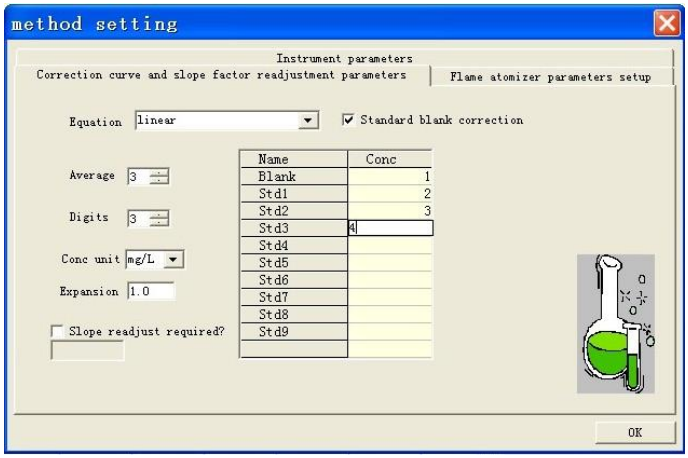


Figure 5-9

7. Press "OK" to close the dialog. Now, the "Standard blank" button should be enabled. See Figure 5-10.

ATTENTION

If the standard blank and the sample blank are substances belonging to different systems, blank correction should be conducted separately for them.

If the concentration of the standard blank sample and that of deionized water, you should select "Standard blank".

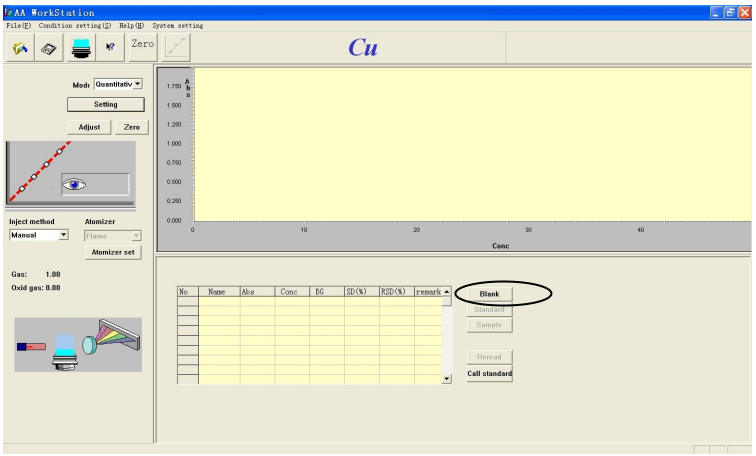


Figure 5-10

8. Suck deionized water, and press "Zero" to zero the instrument. After zeroing is entered, spray and suck the standard sample blank. Press "Standard blank", and the screen will be shown as that in Figure 5-11.

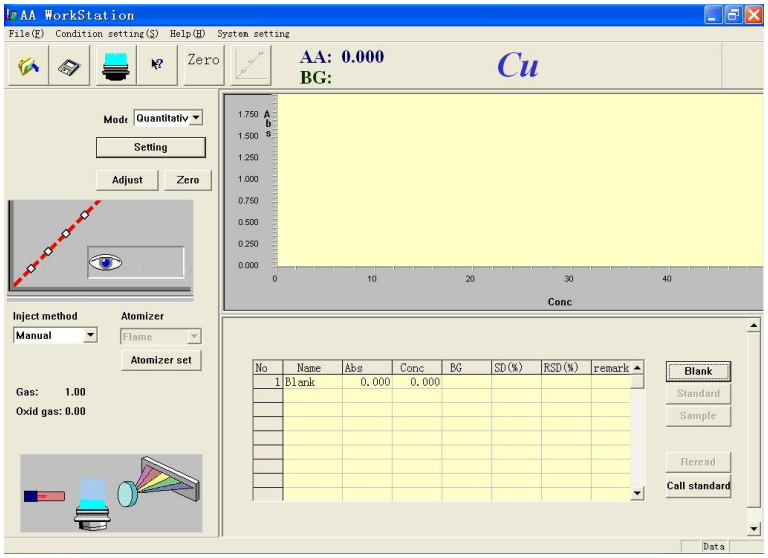


Figure 5-11

9. Spray and suck the standard sample blank for the second time. Press "Standard blank", and the screen will be shown as that in Figure 5-12. The standard blank testing is complete.

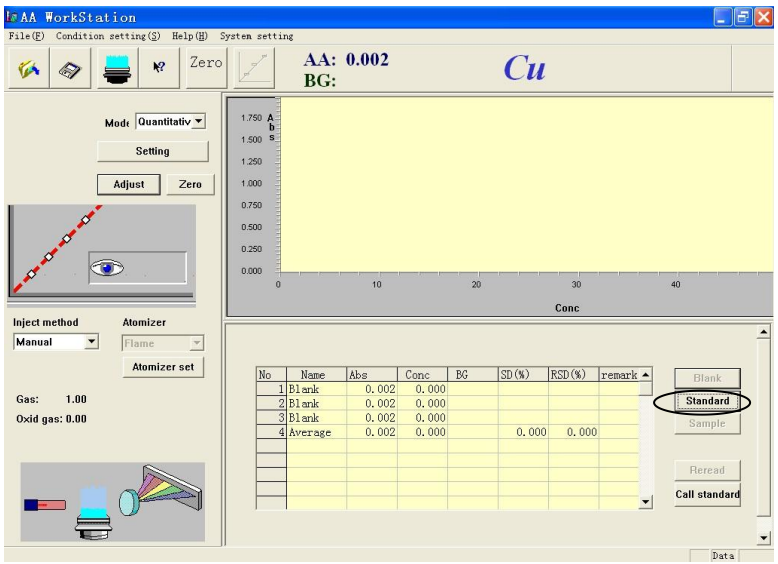


Figure 5-12

10. Spray and suck standard sample 1 blank. Press "Standard sample", and the screen will be shown as that in Figure 5-13.

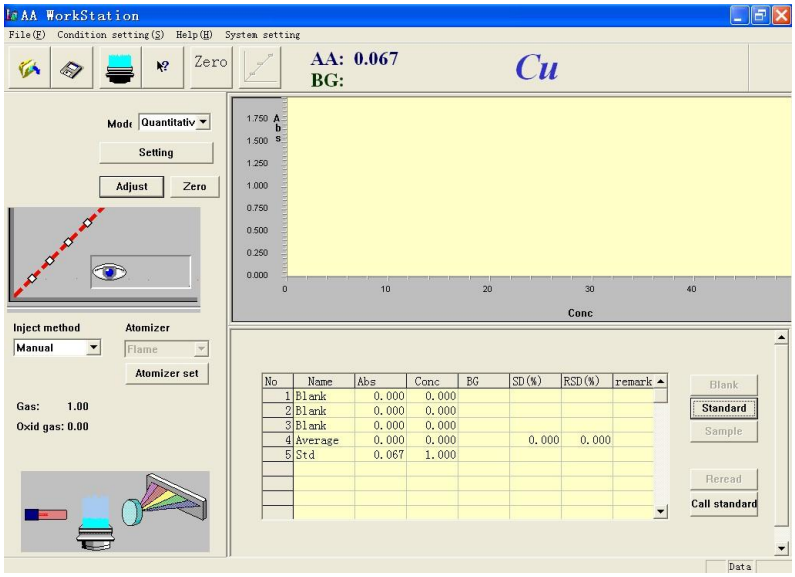


Figure 5-13

11. Spray and suck standard sample 1 blank again. Press "Standard sample", and the screen will be shown as that in Figure 5-14.

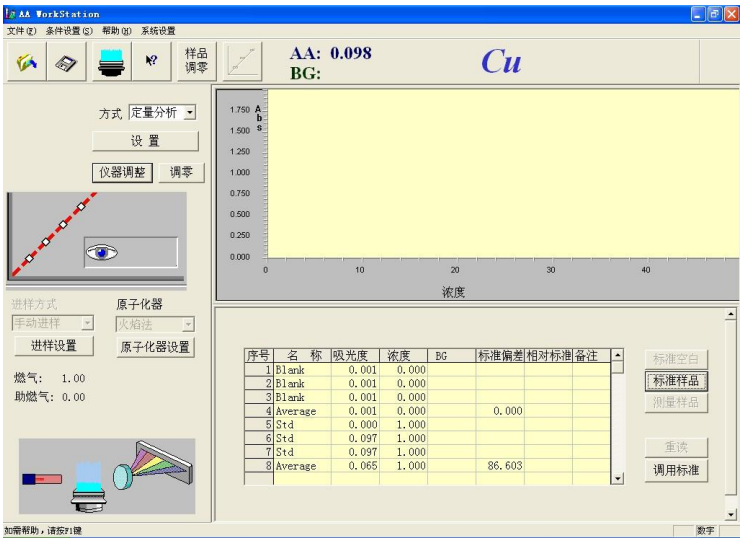


Figure 5-14

12. Measure the other two standard samples according to the steps described above. After the standard samples have been tested, and the screen will be shown as that in Figure 5-15. The standard sample testing is complete.

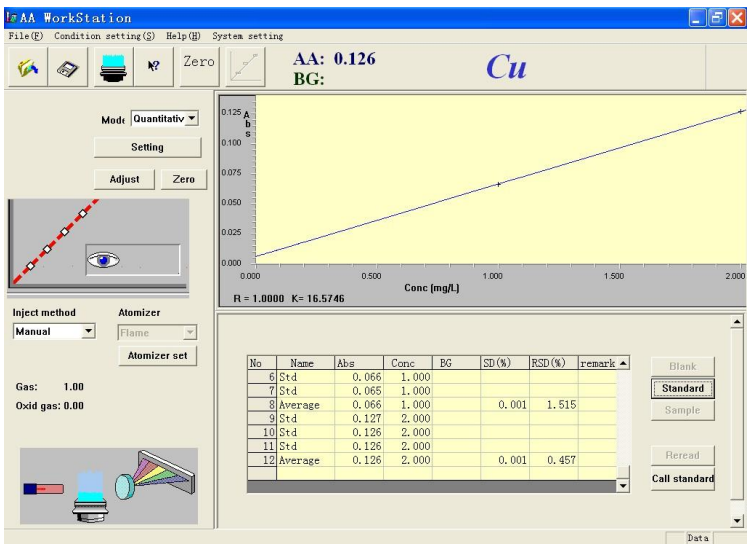


Figure 5-15

13. If you are not satisfied with the test results, you may restart the testing. See "**Standard Sample Rereading and Deletion, and Name Modification**" for information of the method.
14. Start to measure the samples to be tested according the method described above.
15. After the testing is completed, you can save and print the test data.
16. After the standard curve has been completed, right click the mouse and the screen will be shown as that in Figure 5-15a. Now, you may change the curve fitting mode (linear or curve correction) at any time. In the figure, curve correction is selected, i.e. the curve fitting mode.

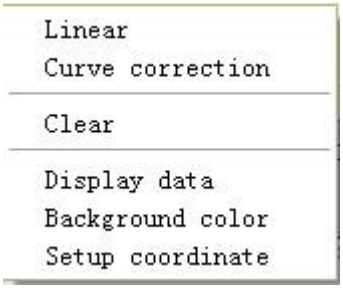


Figure 5-15a

Curve Method

The curve method is suitable for quantitative analysis of elementary samples whose standard curves are nonlinear.

Take a Cu lamp for example, and lamp 1 is the one currently being used.

1. For light source correction, see "**Light source correction**".
2. For igniting the flame, see "**Ignition operation**".
3. Enter a proper value in the "Integration time" field and select a proper reading method in the "Instrument parameters" screen.
4. As shown in Figure 5-16, select "Quantitative analysis" in the pull-down list.

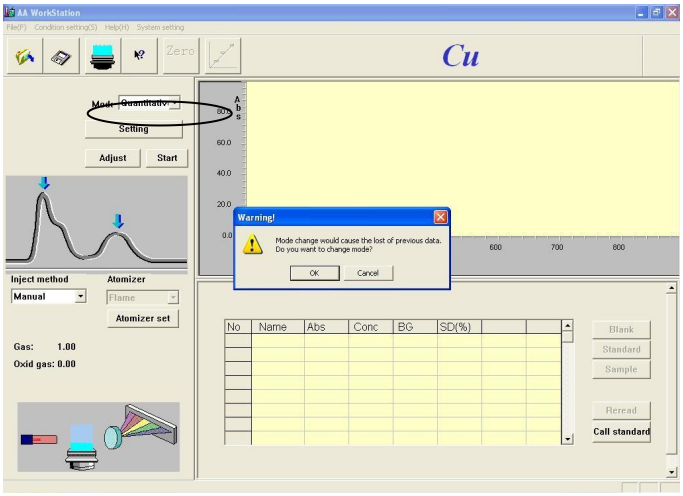


Figure 5-16

5. Press "Settings" to enter the "Correction curve and slope factor readjustment parameters" screen, as shown in Figure 5-17.

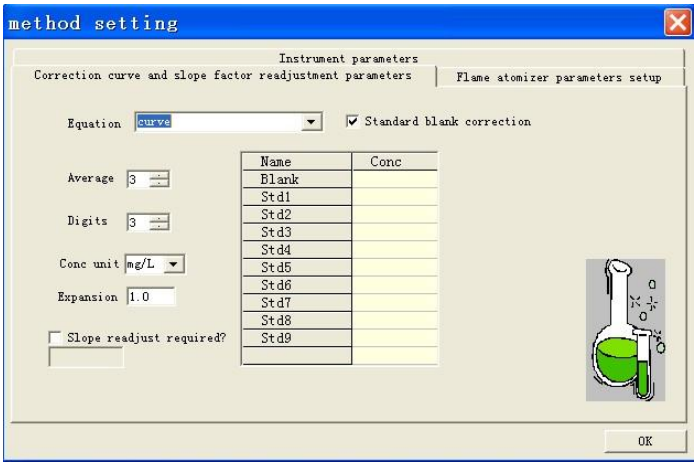


Figure 5-17

6. Select "Curve correction" in the "Equation selection" pull-down list. Determine the conditions based on the actual needs. See Figure 5-18.

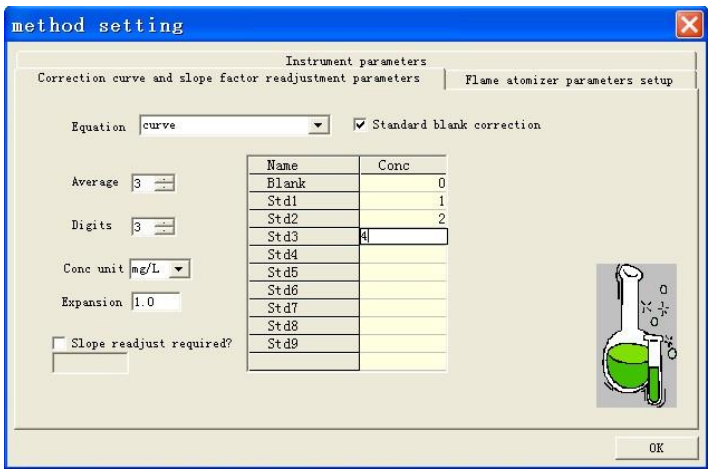


Figure 5-18

ATTENTION **At least 3 standard sample points should be entered, when the curve methods is used.**

7. The testing method is the same as that for the "Linear method".
8. If you are not satisfied with the test results, you may restart the testing. See "**Standard Sample Rereading and Deletion, and Name Modification**" for information of the method.
9. After the standard sample testing is complete, the screen will be shown as that in Figure 5-19.

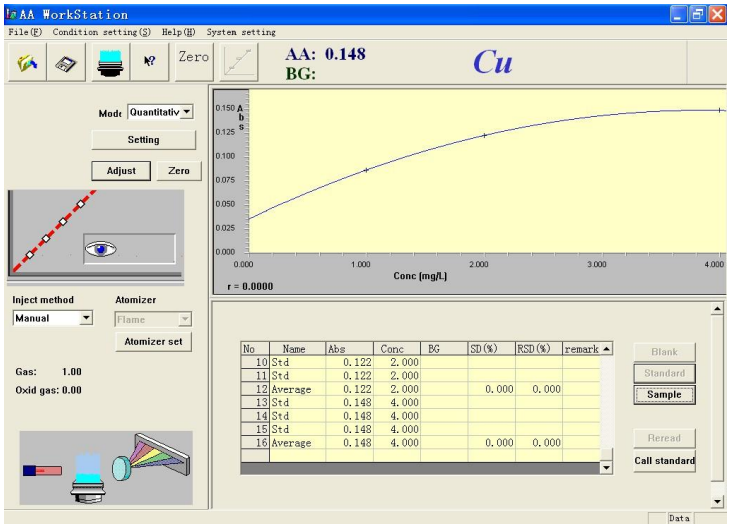


Figure 5-19

10. Start testing the samples with the method the same as that for testing of standard samples.
11. After the testing is completed, you can save and print the test results.

Linear Standard Addition Method

Standard addition methods are methods to exclude the matrix interference and accurately determine the content of elements being analyzed without removal of the matrix interference. The methods include the linear standard addition method and the curve standard addition method.

Take a Cu lamp for example, and lamp 1 is the one currently being used.

1. For light source correction, see "**Light source correction**".
2. For igniting the flame, see "**Ignition operation**".
3. Enter a proper value in the "Integration time" field and select a proper reading method in the "Instrument parameters" screen.
4. As shown in Figure 5-20, select "Quantitative analysis" in the pull-down list.

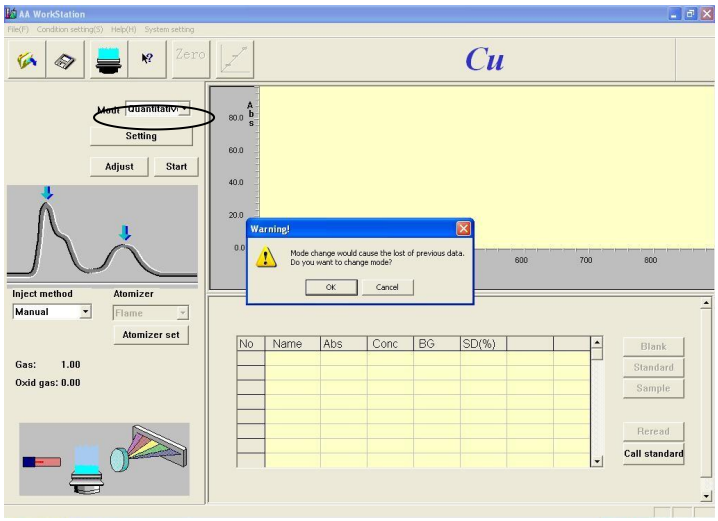


Figure 5-20

5. Press "Settings" to enter the "Correction curve and slope factor readjustment parameters" screen, as shown in Figure 5-21.

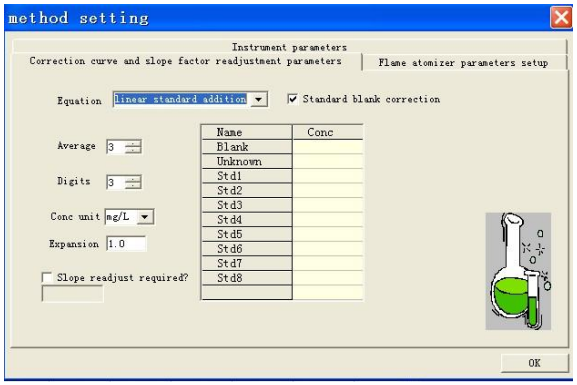


Figure 5-21

6. Select "**Linear standard addition method**" in the "Equation selection" pull-down list. Determine the conditions based on the actual needs. See Figure 5-22.(**Attention: At least 2 standard sample points should be entered.**)

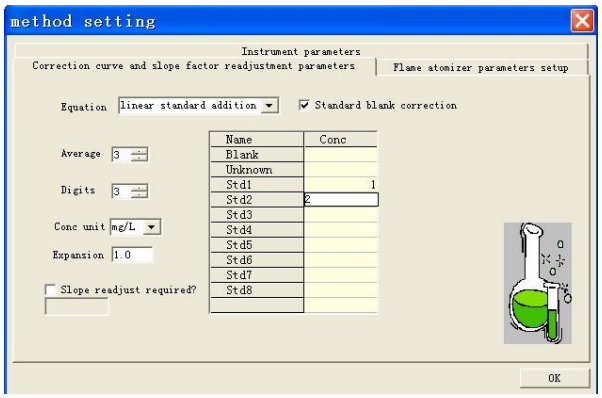


Figure 5-22

7. Press "OK" to close the dialog. Now, the "Standard blank" button should be enabled. See Figure 5-23.

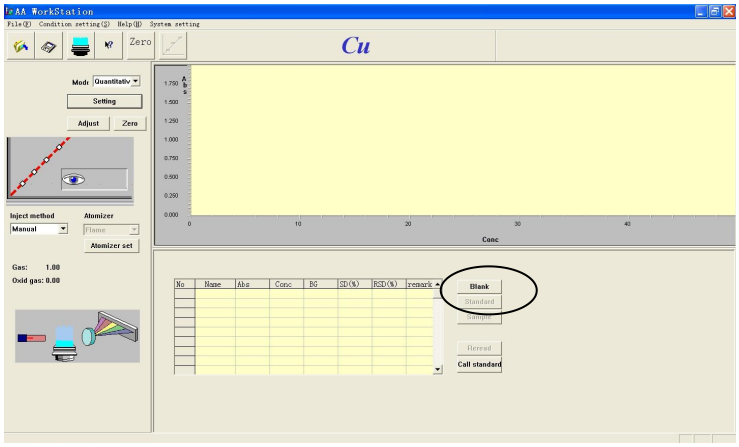


Figure 5-23

8. Suck deionized water, and press "Zero" to zero the instrument.
9. Spray and suck the standard sample blank. Press "Standard blank", and the screen will be shown as that in Figure 5-24.

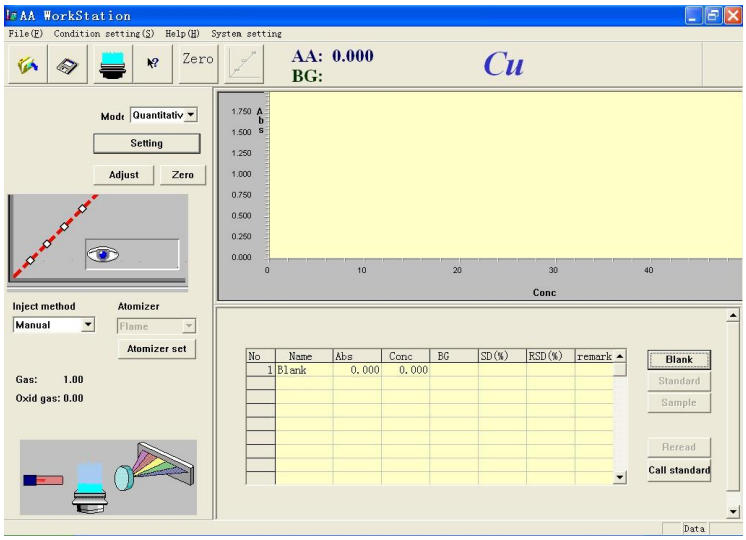


Figure 5-24

10. Spray and suck the standard sample blank again. Press "Standard blank", and the screen will be shown as that in Figure 5-25.

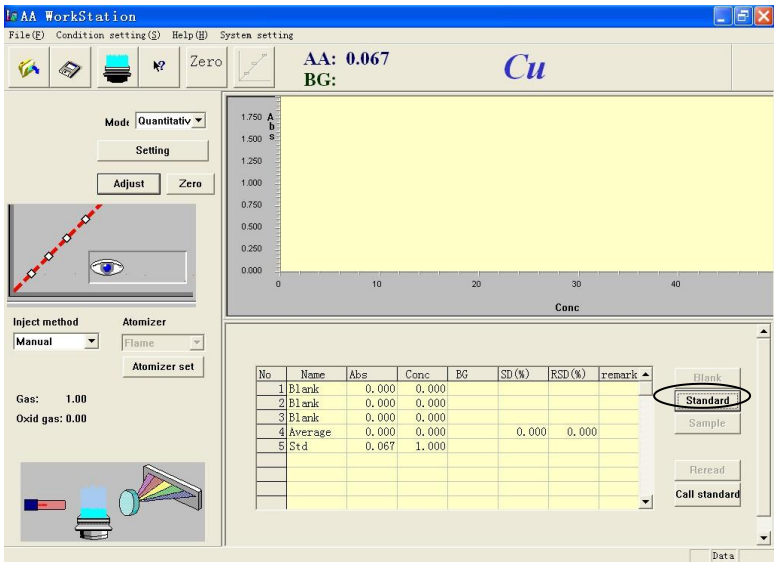


Figure 5-25

11. Start testing an unknown sample. Spray and suck the unknown sample. Press "Unknown sample", and the screen will be shown as that in Figure 5-26.

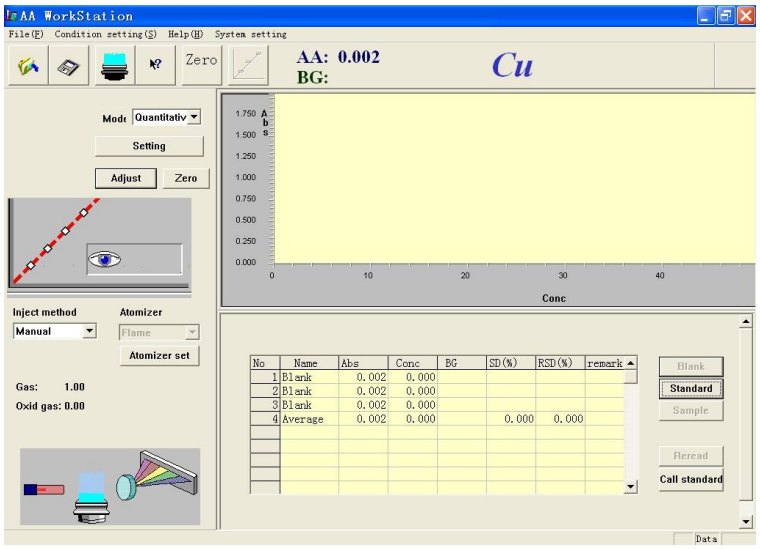


Figure 5-26

12. Spray and suck the unknown sample again. Press "Unknown sample", and the screen will be shown as that in Figure 5-27.

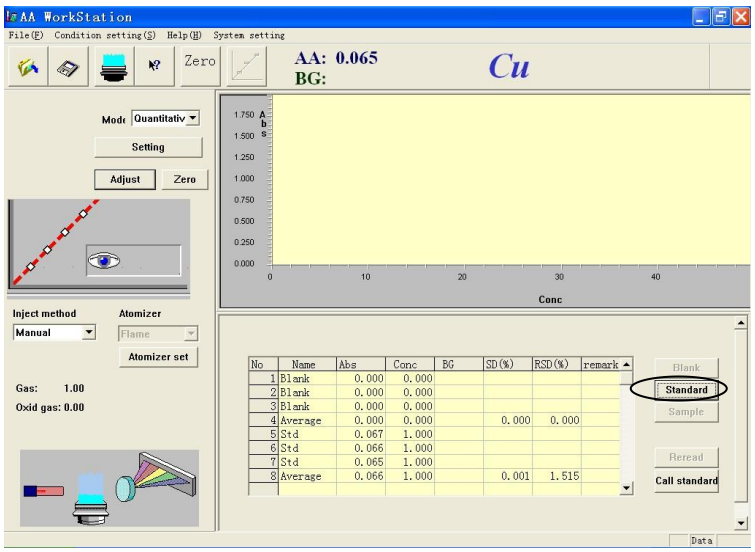


Figure 5-27

13. Complete testing of two standard samples according the methods described above. After the standard sample testing is complete, the screen will be shown as that in Figure 5-28. After the standard sample testing is complete, the concentration of the unknown sample has also been obtained after calculation.

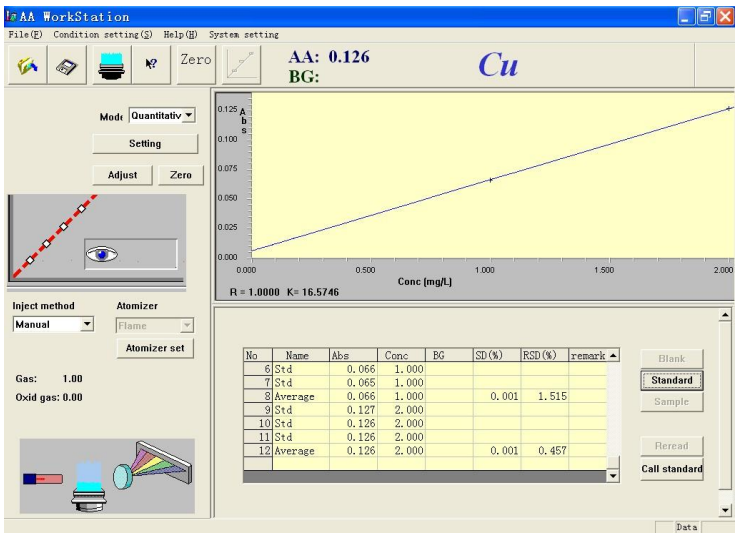


Figure 5-28

14. If you are not satisfied with the test results, you may restart the testing. See "**Standard Sample Rereading and Deletion, and Name Modification**" for information of the method.
15. Start testing the samples with the method the same as that for testing of "Unknown samples", as shown in Figure 5-29.

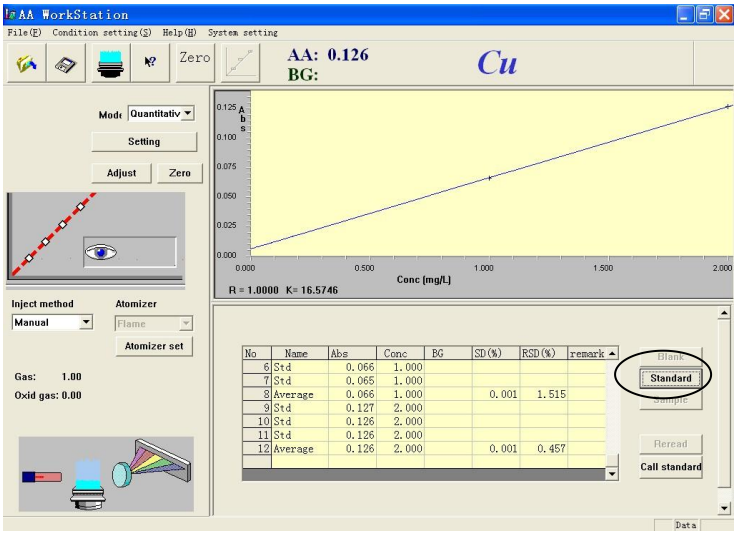


Figure 5-29

After the testing is completed, you can save and print the test results.

Curve Standard Addition Method

Take a Cu lamp for example, and lamp 1 is the one currently being used.

1. For light source correction, see "**Light source correction**".
2. For igniting the flame, see "**Ignition operation**".
3. Enter a proper value in the "Integration time" field and select a proper reading method in the "Instrument parameters" screen.
4. As shown in Figure 5-30, select "Quantitative analysis" in the pull-down list.

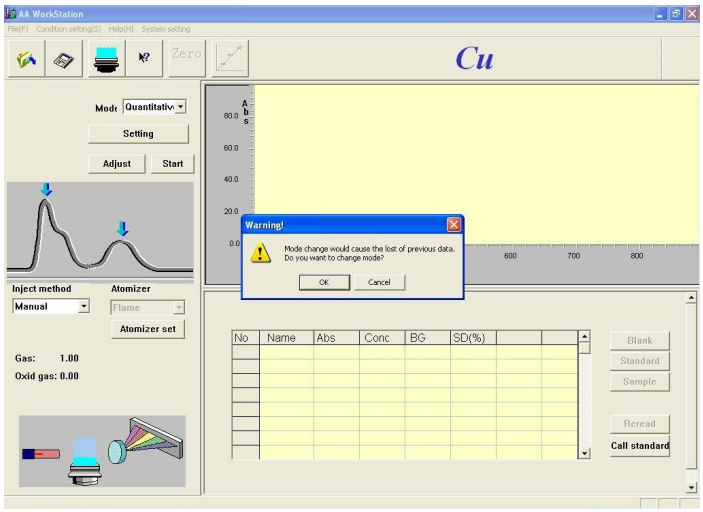


Figure 5-30

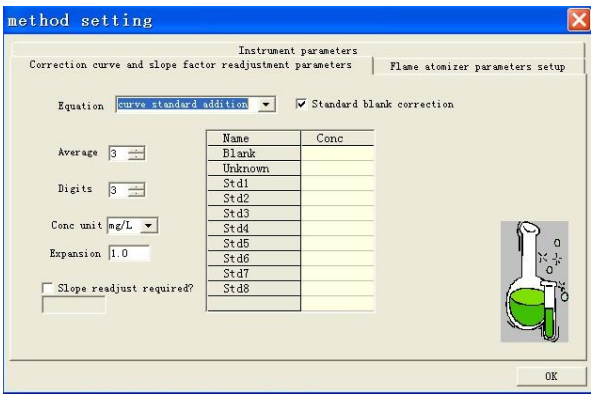


Figure 5-31

5. Press "Settings" to enter the "Correction curve and slope factor readjustment parameters" screen, as shown in Figure 5-31.

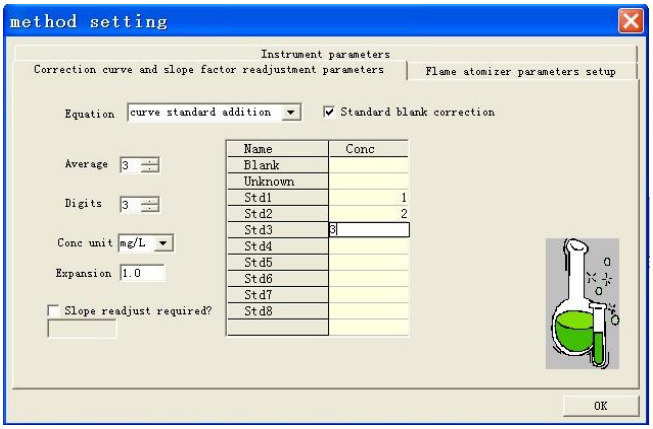


Figure 5-32

6. Select "**Curve standard addition method**" in the "Equation selection" pull-down list. Input the required value. See Figure 5-32.

ATTENTION **At least 3 standard sample points should be entered, when the curve standard addition methods is used.**

7. Press "OK" to close the dialog. Now, the "Standard blank" button should be enabled. See Figure 5-33.

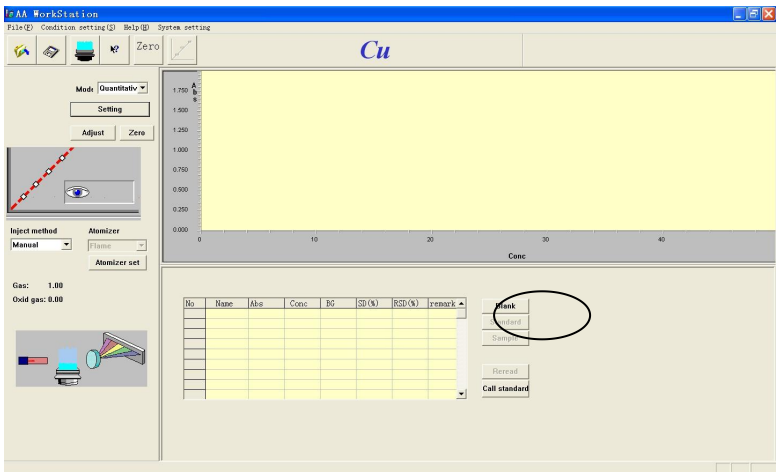


Figure 5-33

8. Start testing the samples with the method the same as that in "**Linear Standard Addition Method**".

9. After the standard sample testing is complete, the screen is shown as that in Figure 5-34.

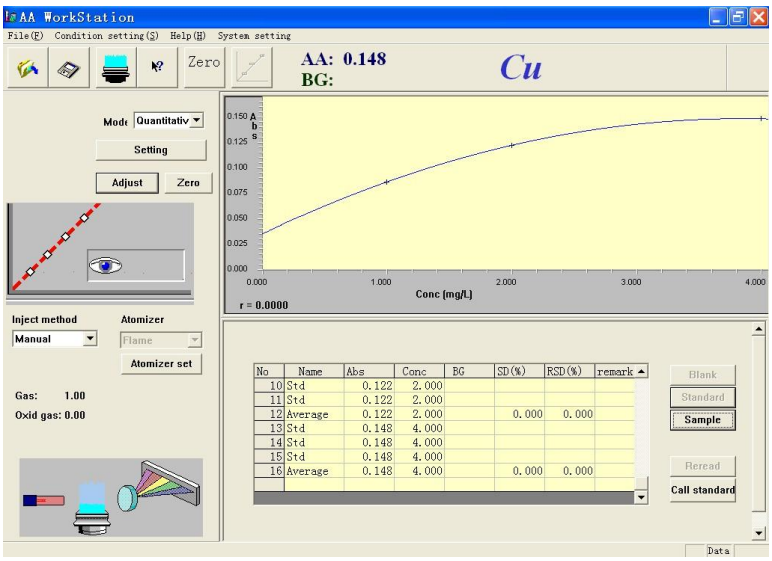


Figure 5-34

10. If you are not satisfied with the test results, you may restart the testing. See "**Standard Sample Rereading and Deletion, and Name Modification**" for information of the method.

11. Start testing the samples.

After the testing is completed, you can save and print the test results.

Single-Point Method

Single-point method is the simplest correction method, which is suitable for determination of elements with linear standard curves passing the origin. However, the concentration of individual standard sample should be close to that of the tested sample to avoid errors.

Take a Cu lamp for example, and lamp 1 is the one currently being used.
Take a Cu lamp for example, and lamp 1 is the one currently being used.

1. For light source correction, see "**Light source correction**".
2. Enter a proper value in the "Integration time" field and select a proper reading method in the "Instrument parameters" screen.
3. As shown in Figure 5-35, select "Quantitative analysis" in the pull-down list.

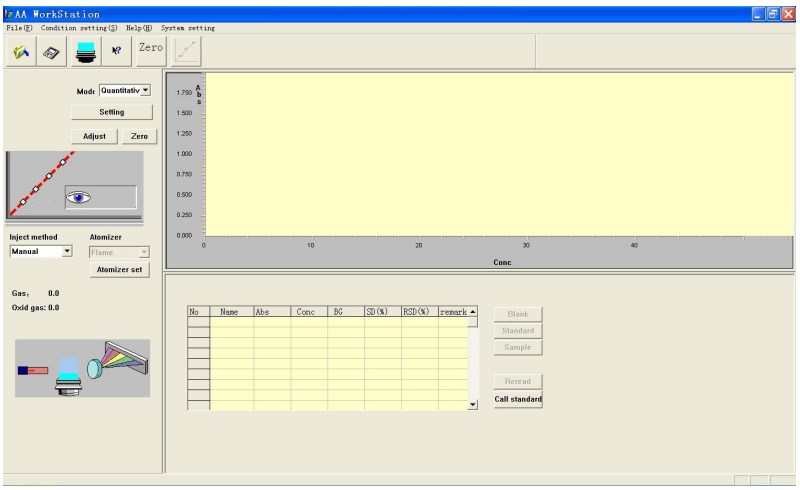


Figure 5-35

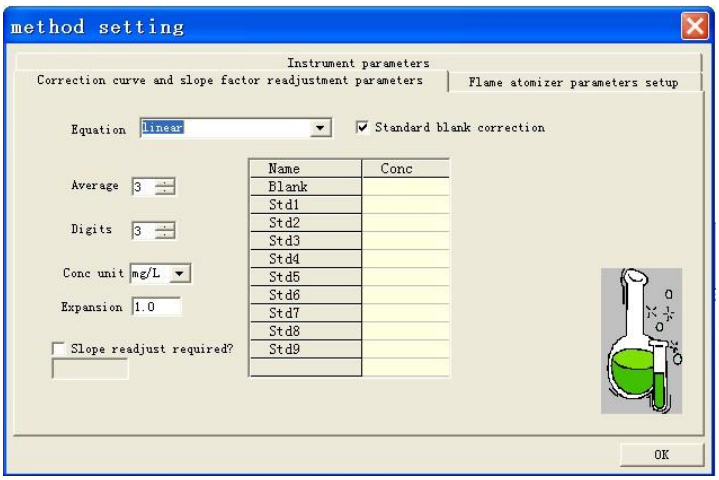


Figure 5-36

4. Press "Settings" to enter the "Correction curve and slope factor readjustment parameters" screen, as shown in Figure 5-36.

5. Select "Single-point method" in the "Equation selection" pull-down list. Determine the conditions based on the actual needs. See Figure 5-37.

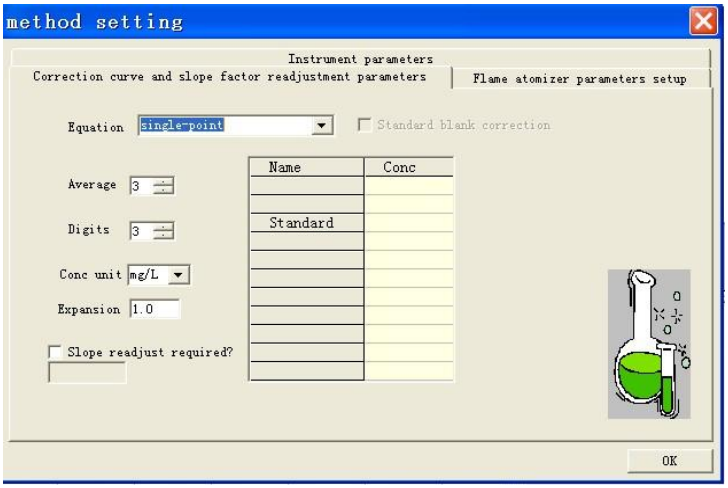


Figure5-37

6. The methods for condition setting and sample testing method are the same as those for the "**Linear method**".

7. The spectrum obtained is shown in Figure 5-38.

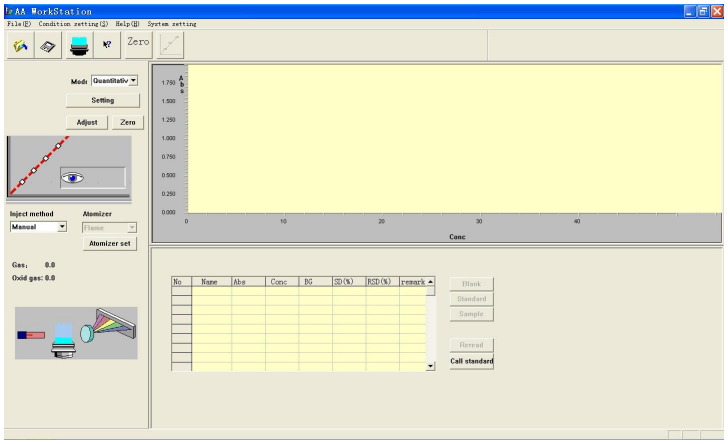


Figure 5-38

After the testing is completed, you can save and print the test results.

Standard Deviation

1. Select "Quantitative analysis" as shown in Figure 3-39a.

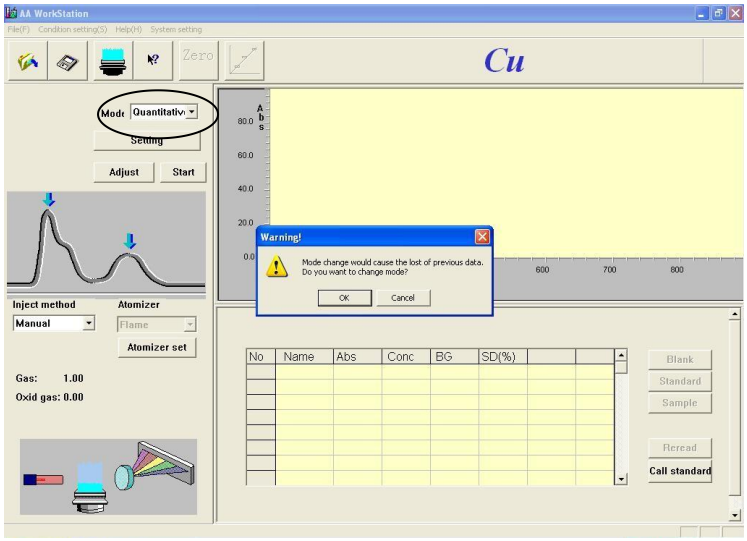


Figure 5-39a

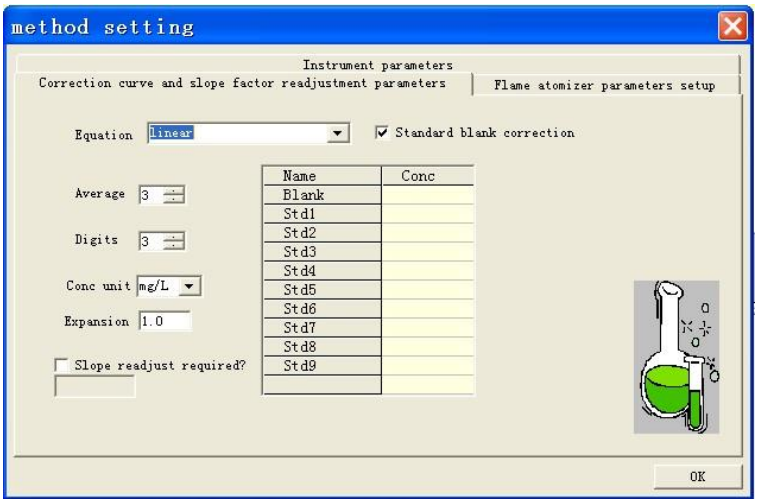


Figure 5-39b

2. Press "Settings" to enter the "Correction curve and slope factor readjustment parameters" screen, as shown in Figure 3-39b.

3. Select "Standard deviation" in the "Equation selection" pull-down list. Enter the parameters as shown in Figure 3-39c.

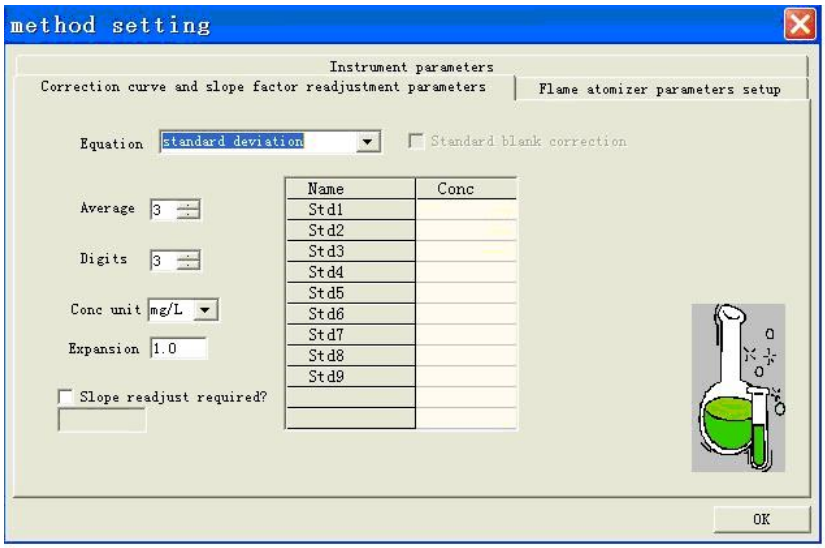


Figure 5-39c

4. Press "OK", and the screen is as shown in Figure 3-39d.

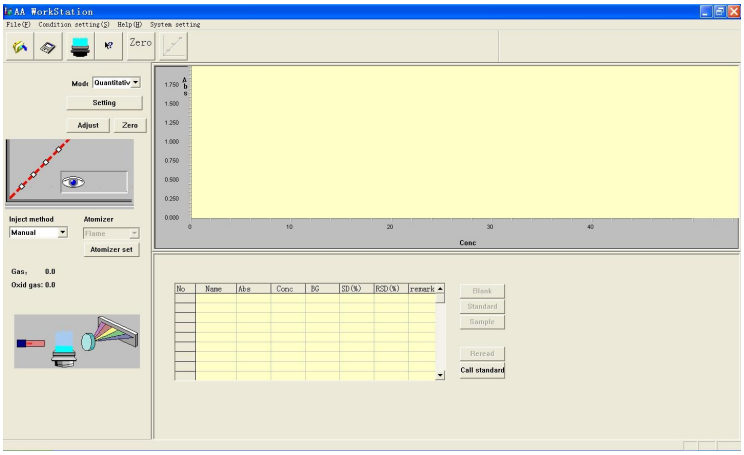


Figure 5-39d

5. Spray and suck the blank sample. Press “Blank”, and the screen will be shown as that in Figure 3-39e.

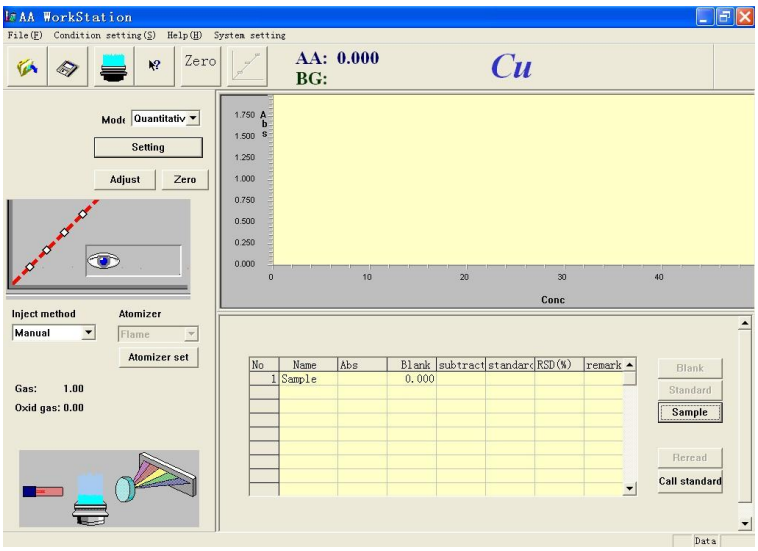


Figure 5-39e

6. Spray and suck the standard sample. Press “Test sample”, and the screen will be shown as that in Figure 3-39f.

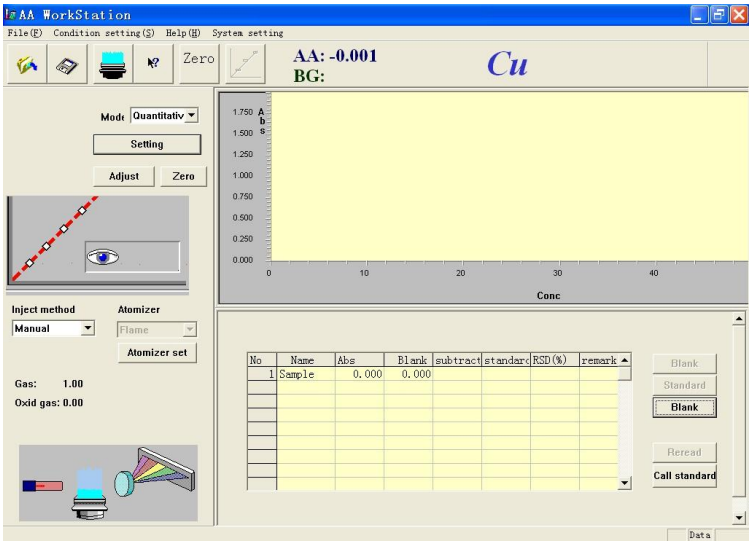


Figure 5-39f

7. Spray and suck the blank sample again, and Press “Blank”.

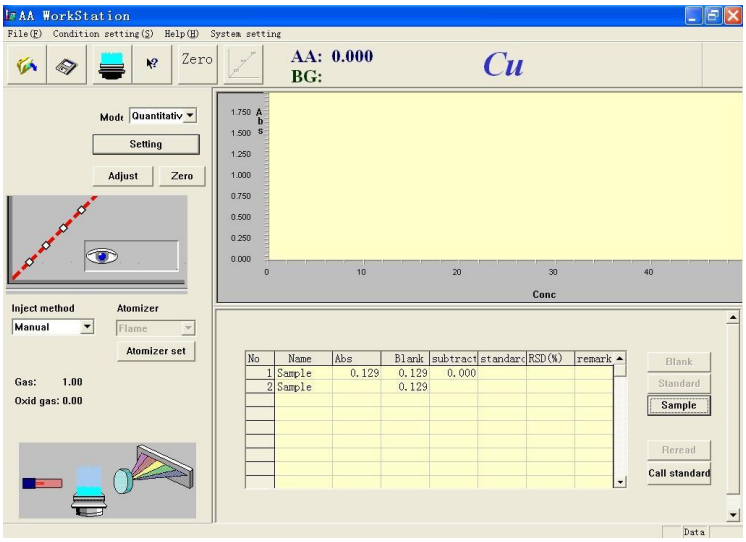


Figure 5-39g

8. Repeat the steps above for seven times and the screen will be shown as that in Figure 3-39h.

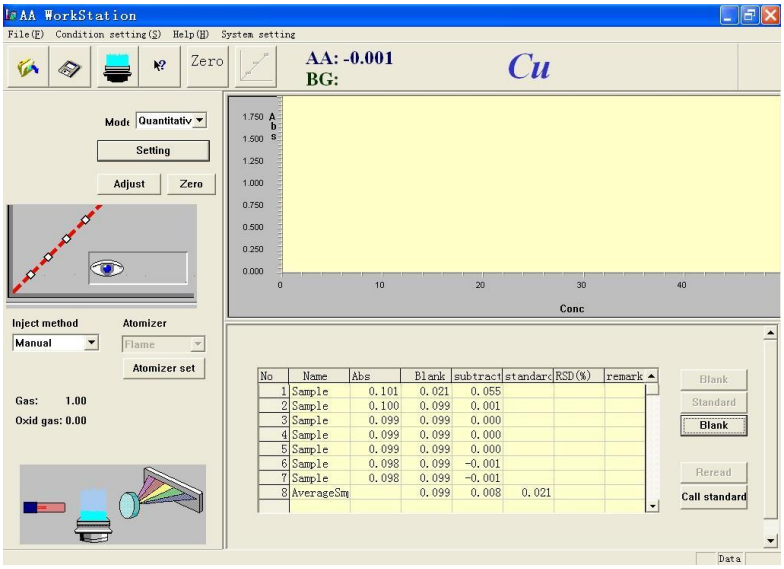


Figure 5-39h

Sample Rereading and Deletion, and Name Modification

Rereading

1. If you are not satisfied with the test data after testing of the samples, you may restart the testing. For example, if the results of sample 5 are unsatisfactory, move the curve to select the item as shown in the figure below.

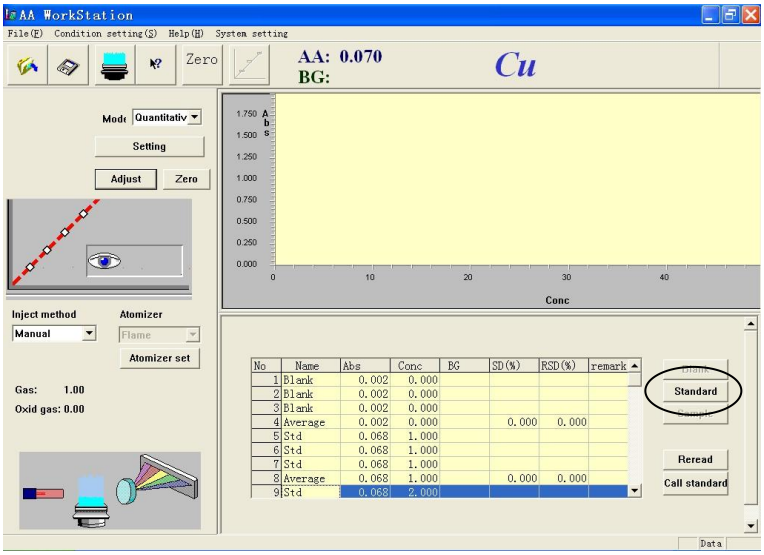


Figure 5-40a

2. Spray and suck the sample again. Press “Reread”, and the screen will be shown as that in Figure 5-40b.

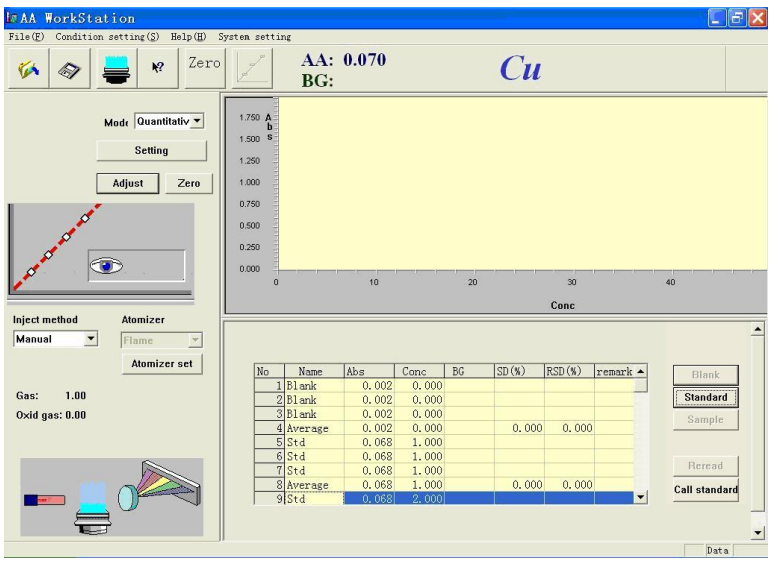


Figure 5-40b

Deletion

1. After the standard sample testing is complete, you can conduct deletion operation. Move the curve onto the number of a standard sample to be deleted, and pressure the right mouse key. The screen will be shown as that in Figure 4-40c.

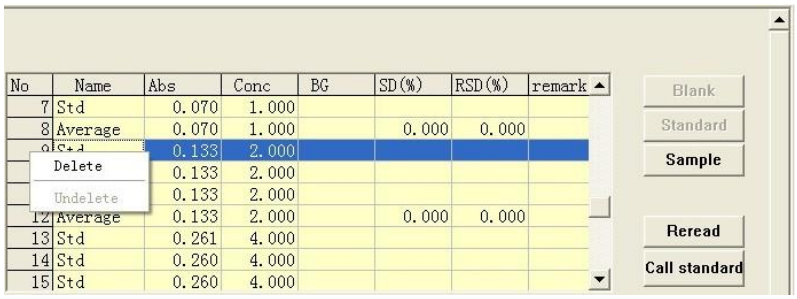


Figure 5-40c

2. Press "Delete", and the screen will be shown as that in Figure 5-40d.

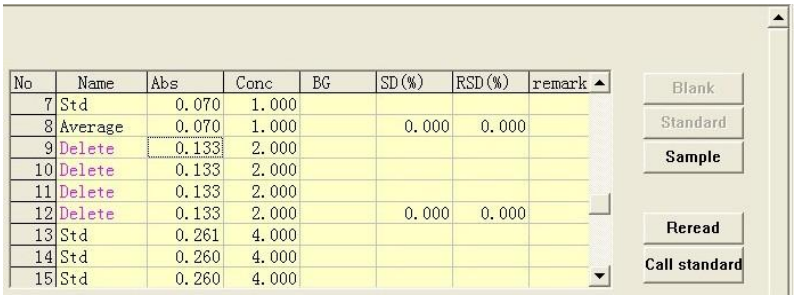


Figure 5-40d

3. To undelete a deleted standard sample, move the cursor onto the deleted standard sample and press the right mouse key. The screen will be shown as that in Figure 5-40d, and then select "Undelete".

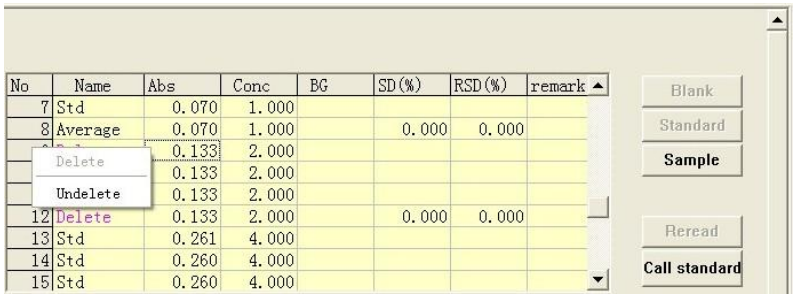


Figure 5-40d

ATTENTION: If sample testing has been done, it is impossible to delete standard samples.

Name Modification

During testing, you may change certain names based on your needs. For example, if you want to modify the name of sample 5 shown in Figure 5-40d, double click the name, and the screens will be shown as those in Figure 5-41a and 5-41b.

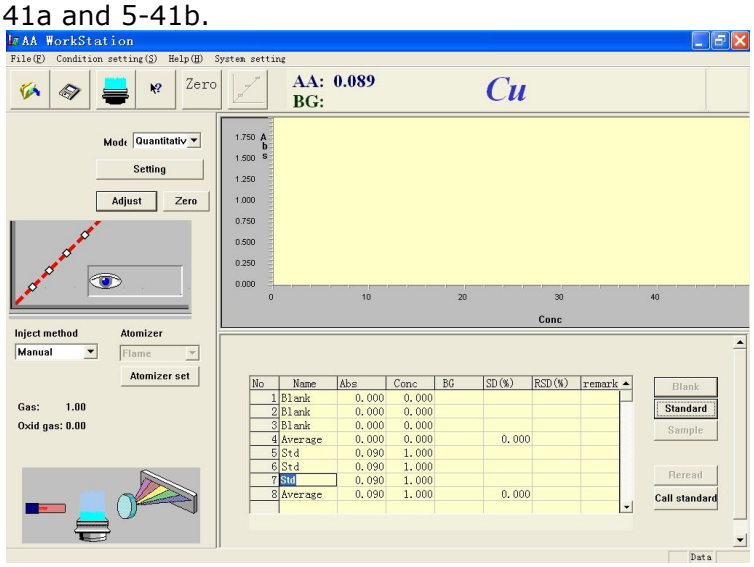


Figure 5-41a

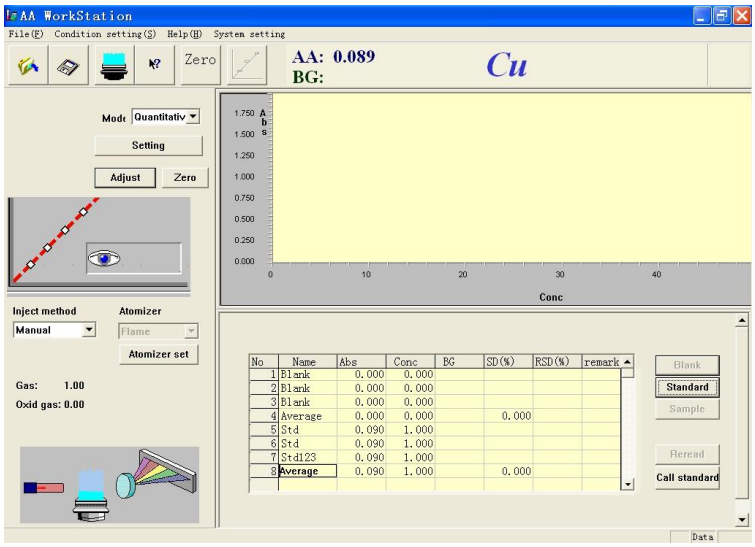


Figure 5-41b

Slop Factor Readjustment

The sensitivity may drift after testing for period of time. The slop factor readjustment may be used in such case.

To set parameters as shown in Figure 5-42, select "Slope factor readjustment" and enter the value 2, which means readjustment for sample 2. Enter other conditions based on the actual needs.

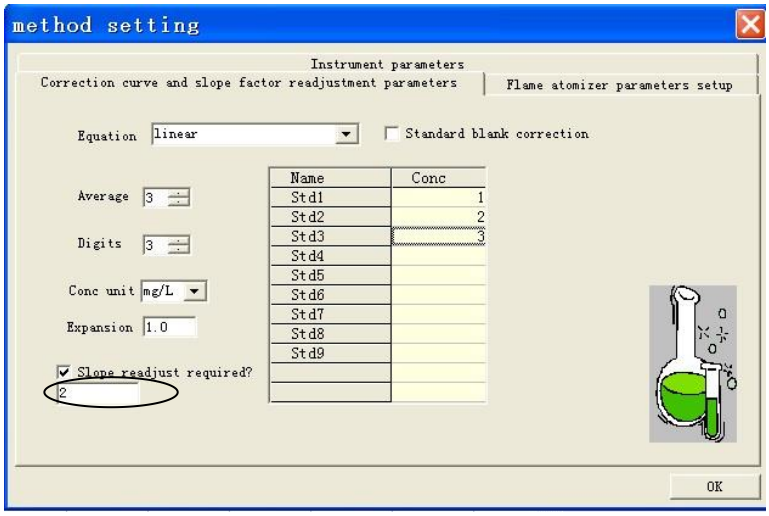


Figure 5-43

ATTENTION: The slope factor readjustment usually is used for the linear method and the linear standard addition method.

Steps: To conduct the slope factor readjustment, spray and suck standard sample 2 again, press the button for readjustment on the toolbar as shown in Figure 5-44 to start the slope factor readjustment, and continue testing of the sample.

Figure 5-44

Saving and Printing

Saving

1. After sample testing is completed, press the "Save" button on the toolbar, as shown in Figure 5-45. Alternatively, select "Save data" in the "File" menu, as shown in Figure 5-46.A dialog will appear as shown in Figure 5-47.

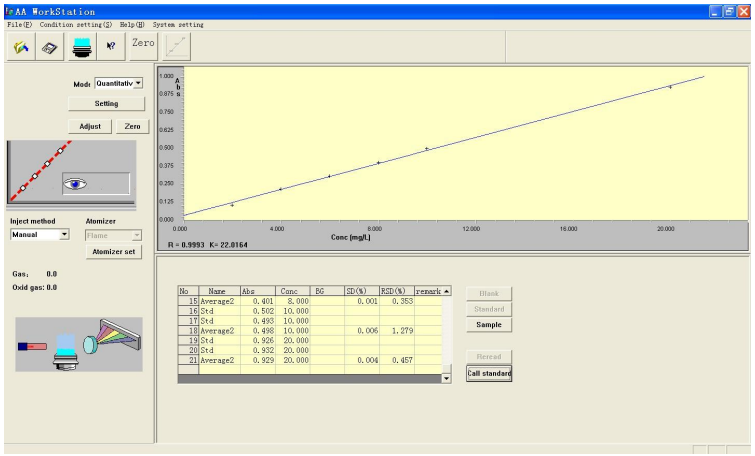


Figure 5-45

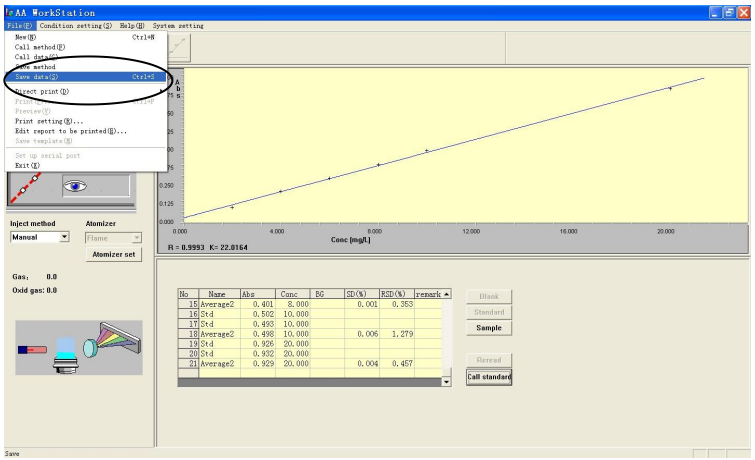


Figure 5-46

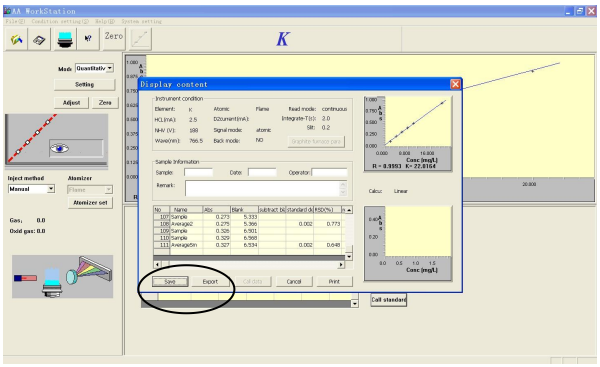


Figure 5-47

2. Enter sample name, operator name, data and remarks in the fields of the "Display information" dialog.
3. Press "Save", and screen will be shown as that in Figure 5-48. Enter the file name and press "Save" to save the file.

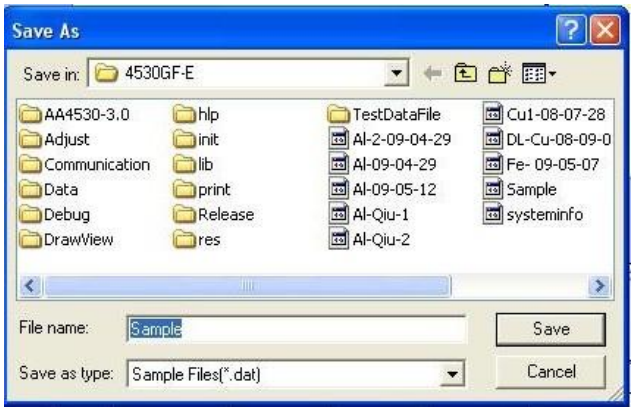
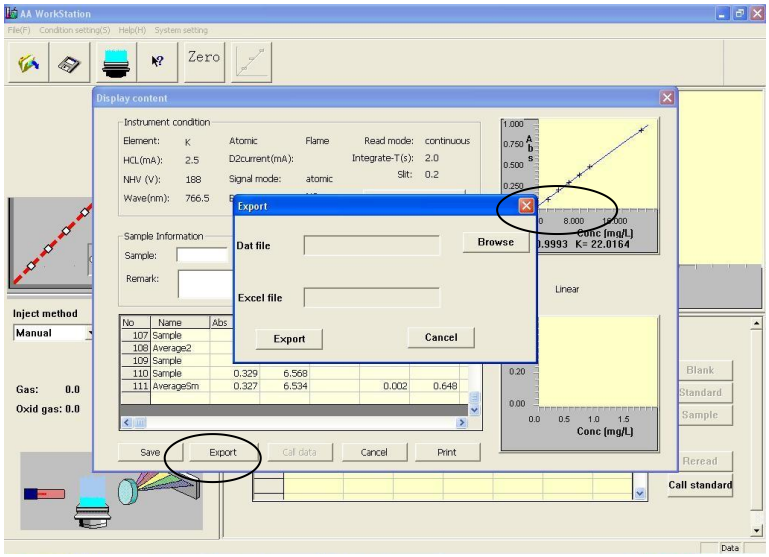


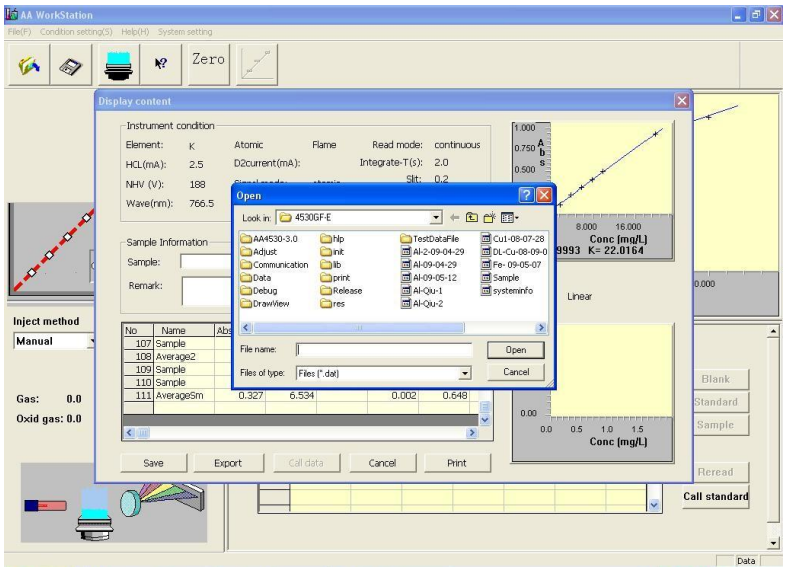
Figure 5-48

Export

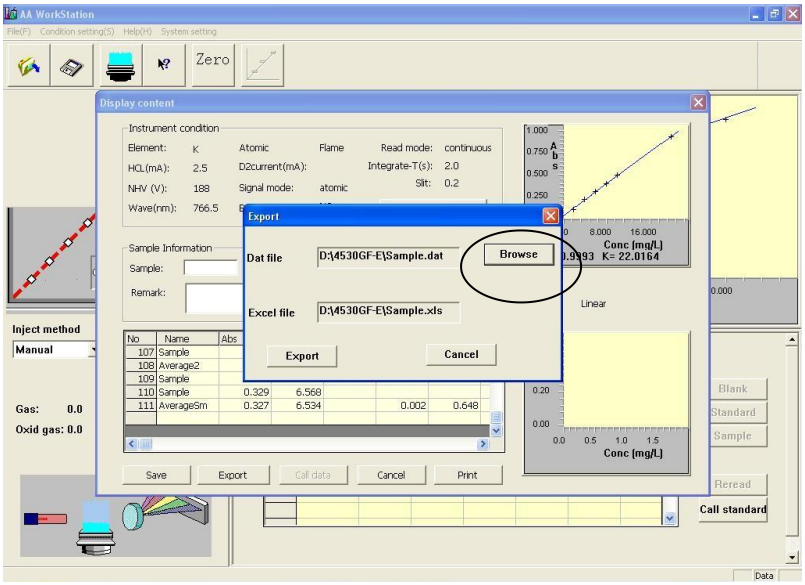
1. Press the "Export" button to export the data into an Excel file.



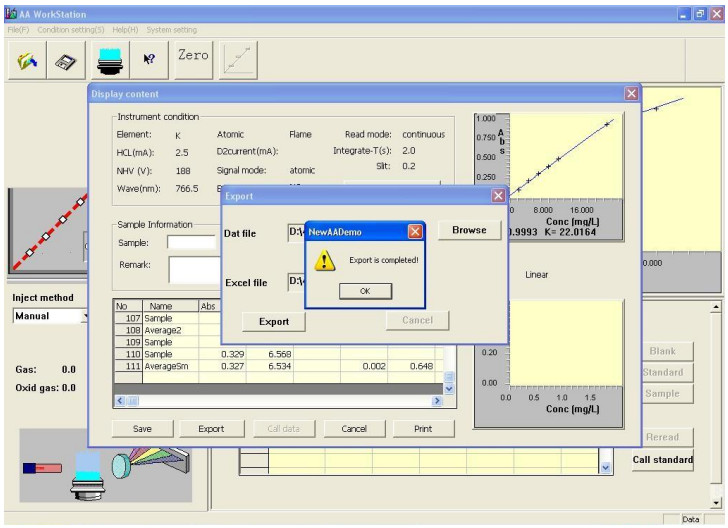
2. Press the “Browse” button.



4. Select the file to be exported.



4. Press the “Export” button. Export is completed.



Printing

After the testing is completed, you can directly print the test results. Steps:

1. Select "Directly printing > Quantitative analysis printing" in the "File" menu, as shown in Figure 5-49. The "Display information" dialog will appear as shown in Figure 5-50.

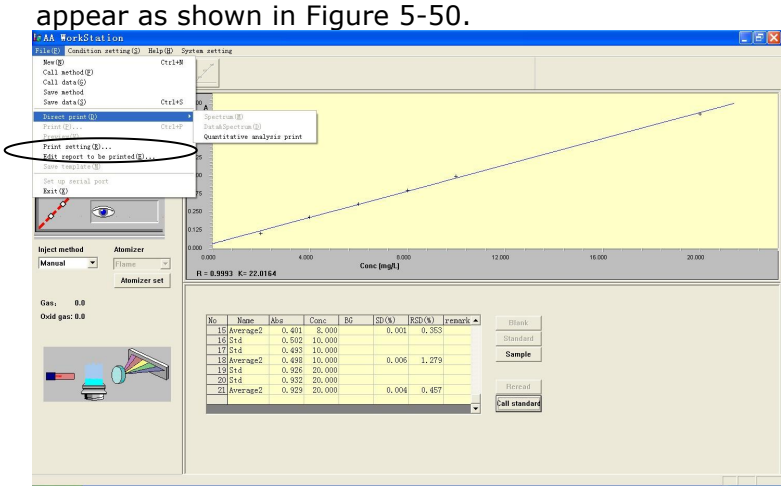


Figure 5-49

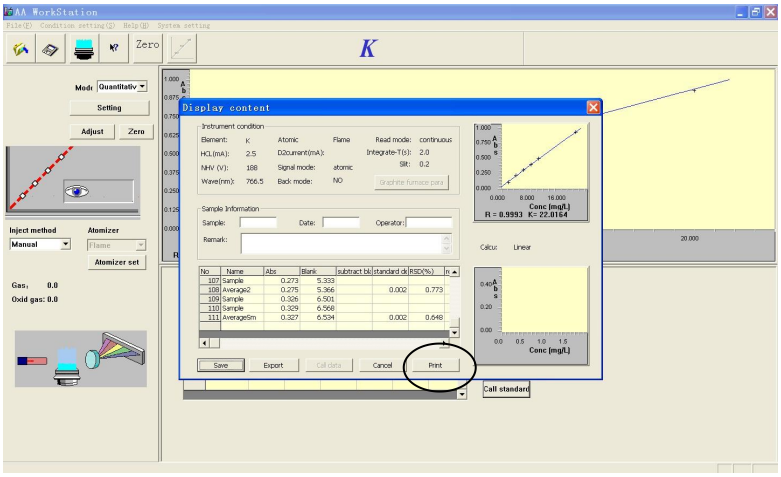


Figure 5-50

2. Press “Print”, and a dialog will appear as shown in Figure 5-51.

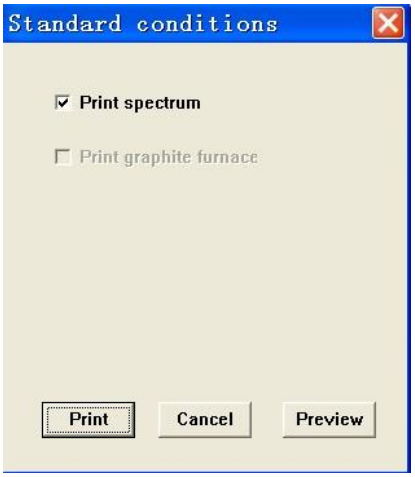


Figure 5-51

3. You may select from the functions available in the dialog based on your needs.

6

Background Correction Flame Mode

Background Correction Flame Mode

Lamp 1 is the one currently being used.

1. For igniting the flame, see "**Ignition operation**".
2. Select the "Quantitative analysis" mode.
3. Press "Instrument adjustment" to show a dialog as shown in Figure 6-1.

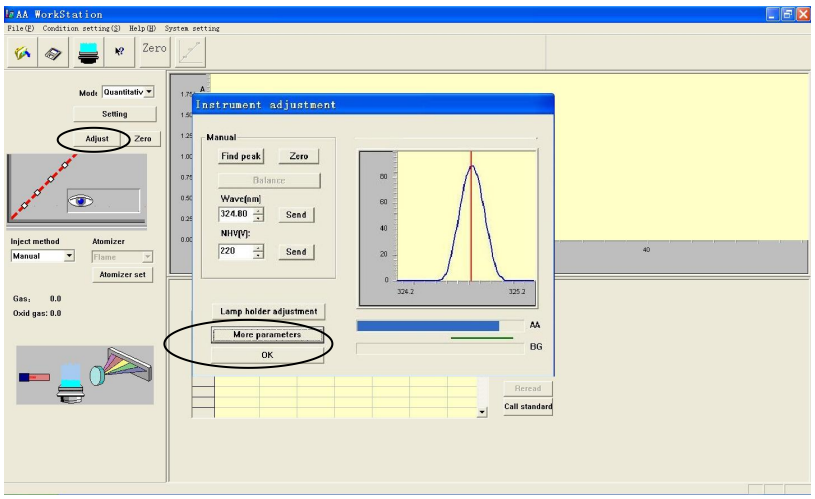


Figure 6-1

4. Press "More parameters" in the "Instrument adjustment" dialog to show another dialog as shown in Figure 6-2.

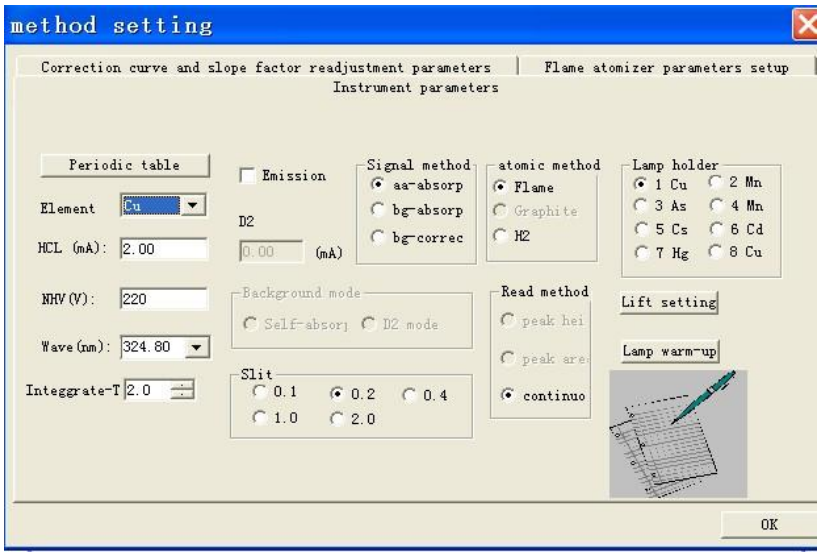


Figure 6-2

5. Select element Cu, select "Background correction" for the signal mode and "Deuterium lamp" for the background mode, and set other parameters as shown in Figure 6-3.

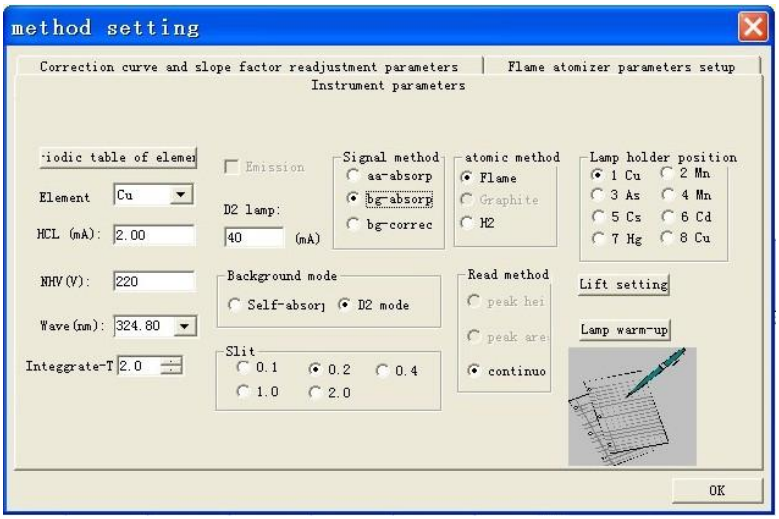


Figure 6-3

6. Press "OK", and the screen for light source adjustment will appear as shown in Figure 6-4. See "**Light source correction**" for the steps.

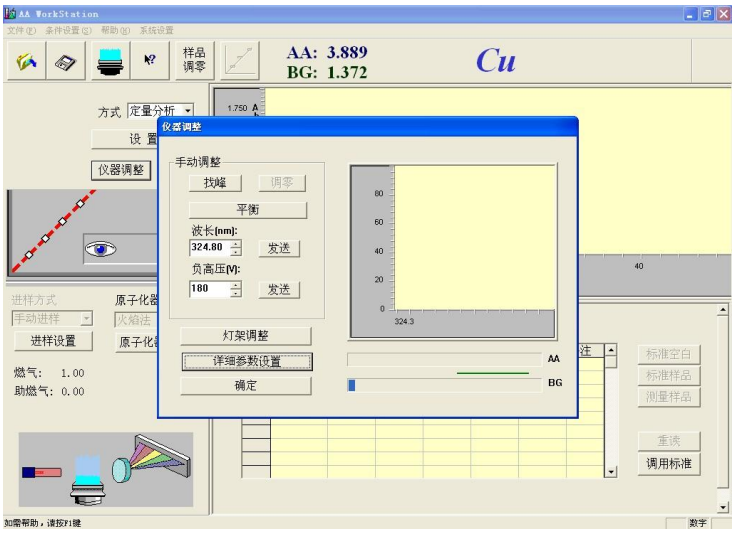


Figure 6-4

7. After light source correction has been completed, as shown in Figure 6-5, press "Balance" to balancing the deuterium lamp and the element lamp.

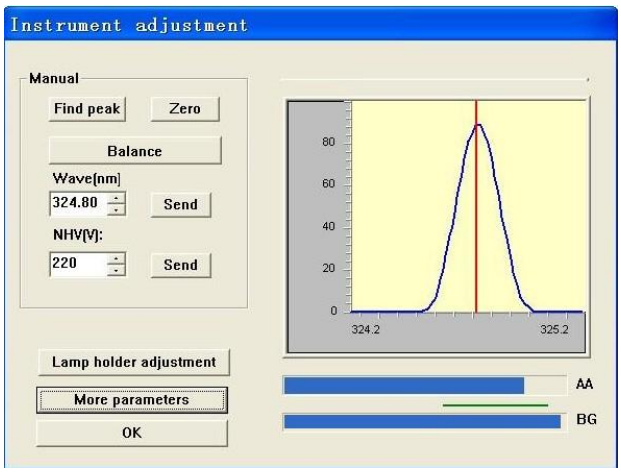


Figure 6-5

8. Press "Balance", and the screen will appear as shown in Figure 6-6.

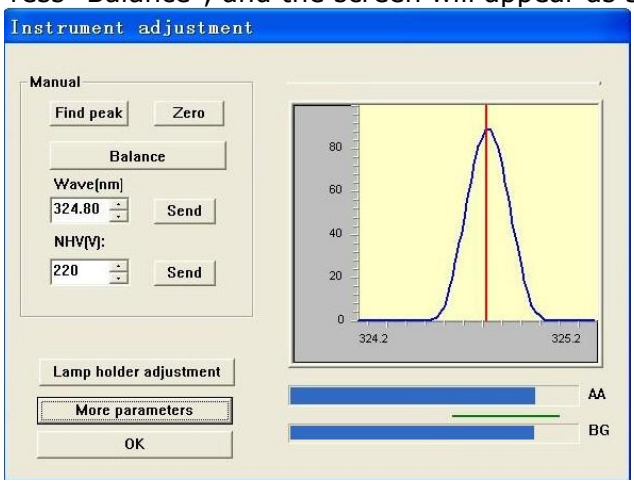


Figure 6-6

9. After the balancing is complete, press "OK" to close the dialog.

10. Press "Settings" to enter the "Correction curve and slope factor readjustment parameters" screen. Select "Linear method" in the "Equation selection" pull-down list. Enter the conditions as shown in Figure 6-8.

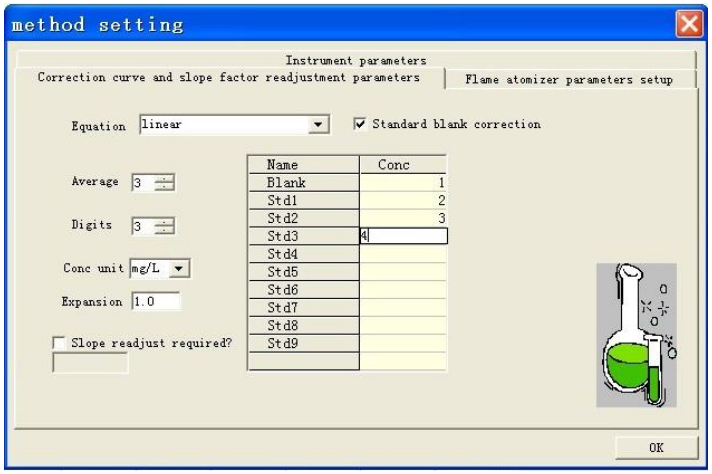


Figure 6-8

11. Press "Zero" to zero the instrument. After zeroing is entered, spray and suck the standard sample 1. Press "Standard blank", and the screen will appear as shown in Figure 6-9.

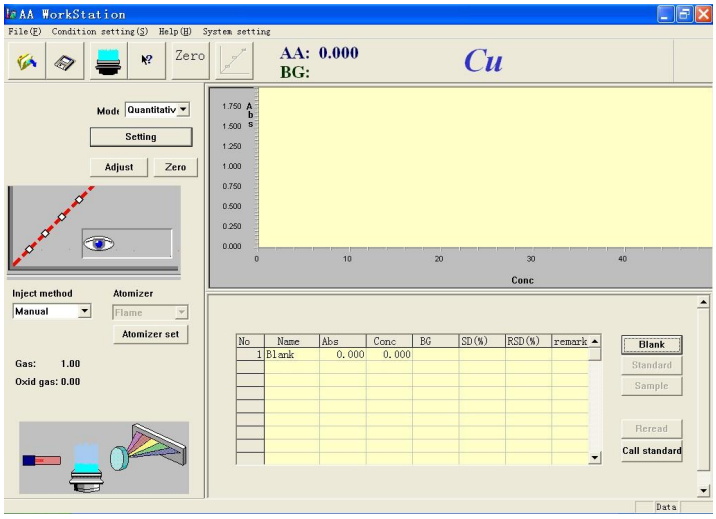


Figure 6-9

Background Correction Flame Mode

12. Spray and suck the standard sample 1 again. Press "Standard blank", and the screen will appear as shown in Figure 6-10.

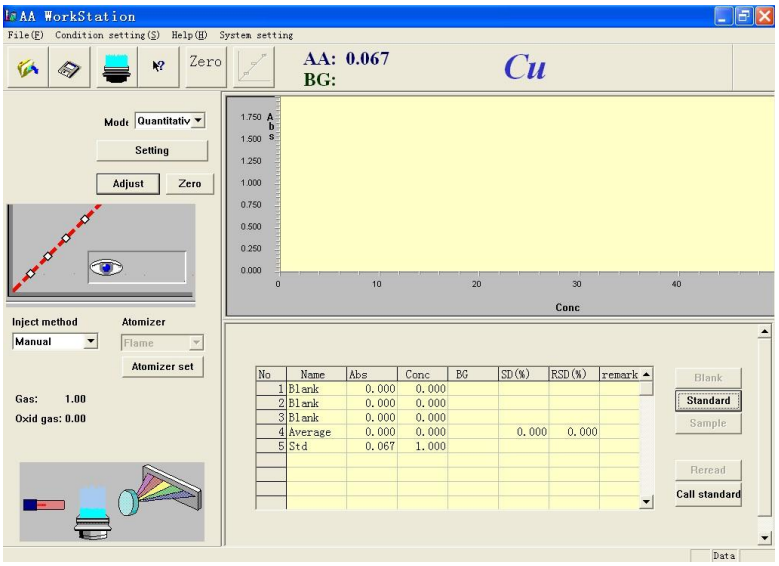


Figure 6-10

13. Complete testing of another two standard samples according the methods described above. After the standard sample testing is complete, the screen will appear as shown in Figure 6-11. The standard sample testing is complete.

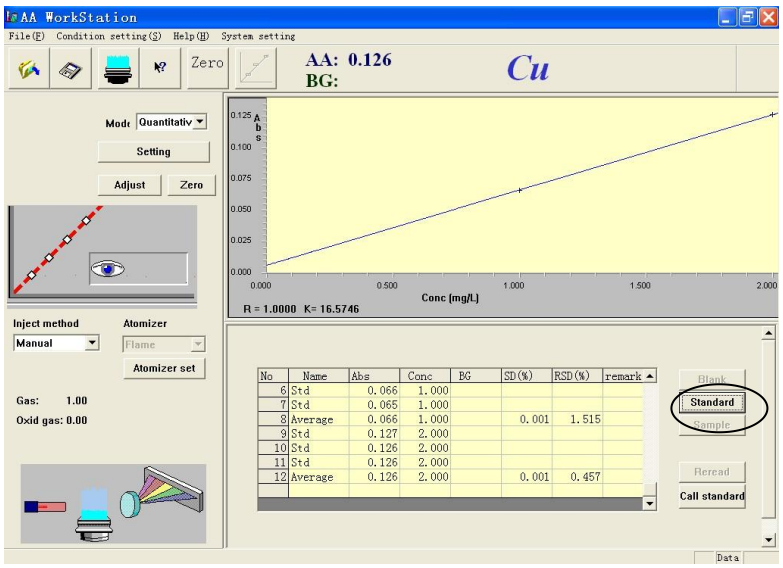


Figure 6-11

14. If you are not satisfied with the test results, you may restart the testing. See "**Standard Sample Rereading**" for the steps.
15. Start testing the samples with the method described above.
16. After the testing is completed, you can save and print the test results.

Self-Absorption

ATTENTION

L-2433 heavy duty element lamps from Hamamatsu Photonics of Japan or other competent manufacturers should be used for self-absorption background correction. If a regular element lamp is used, the performance of the lamp may be degraded.

Lamp 1 is the one currently being used.

1. For igniting the flame, see "**Ignition operation**".
2. Select the "Quantitative analysis" mode.
3. Press "Instrument adjustment" to show a dialog as shown in Figure 6-12.

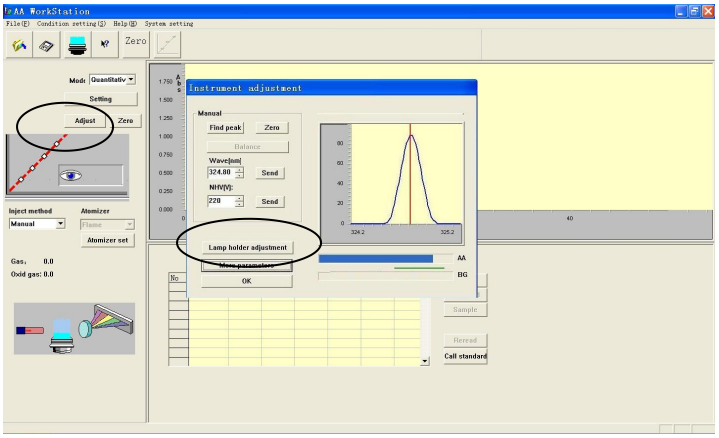


Figure 6-12

4. Press "More parameters" in the "Instrument adjustment" dialog to show another dialog as shown in Figure 6-13.

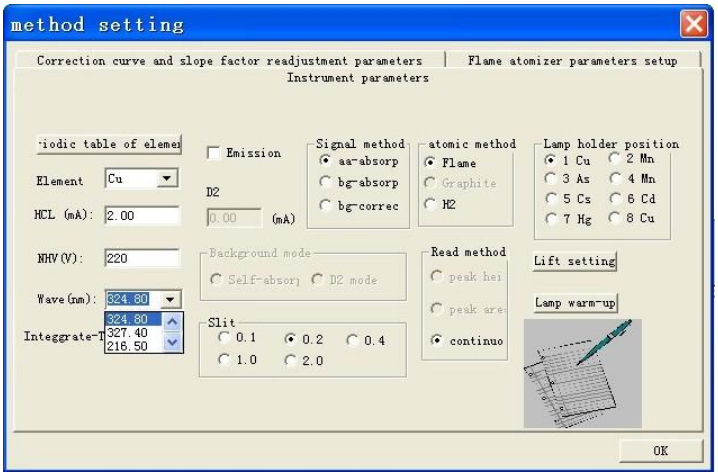


Figure 6-13

5. Select element Cu, select "Background correction" for the signal mode and "Self-absorption" for the background mode, and set other parameters as shown in Figure 6-14.

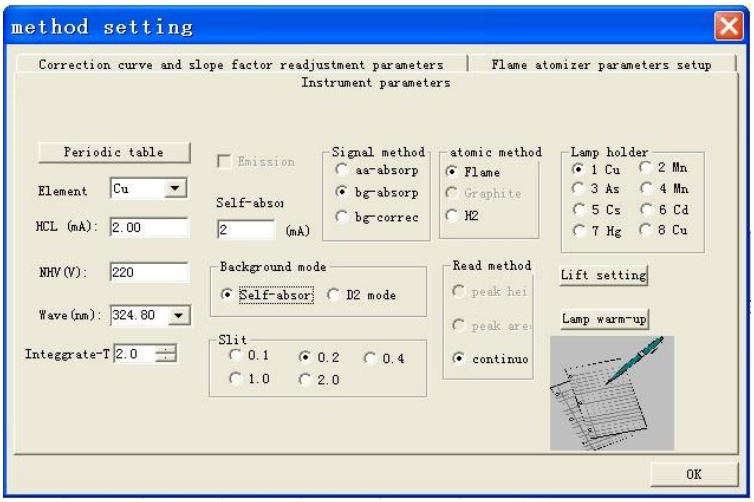


Figure 6-14

6. Press "OK", and the screen for light source adjustment will appear as shown in Figure 6-15. See "**Light source correction**" for the steps.

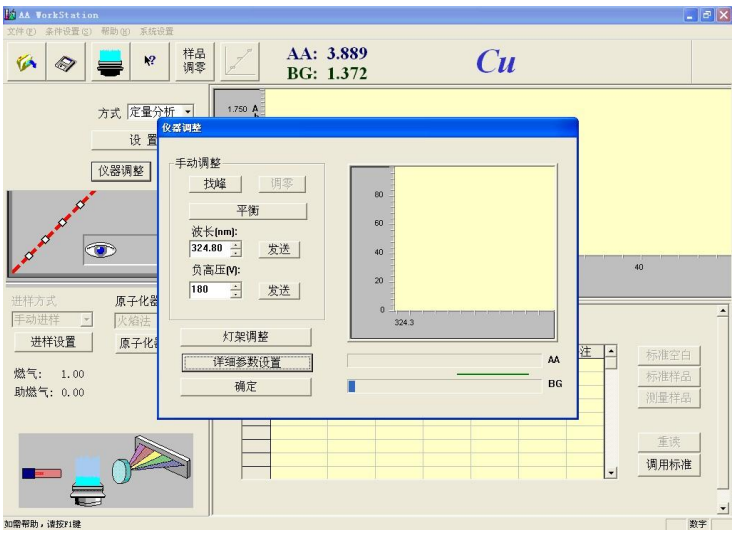


Figure 6-15

7. After light source correction has been completed, as shown in Figure 6-16, press "Balance" to balancing the deuterium lamp and the element lamp.

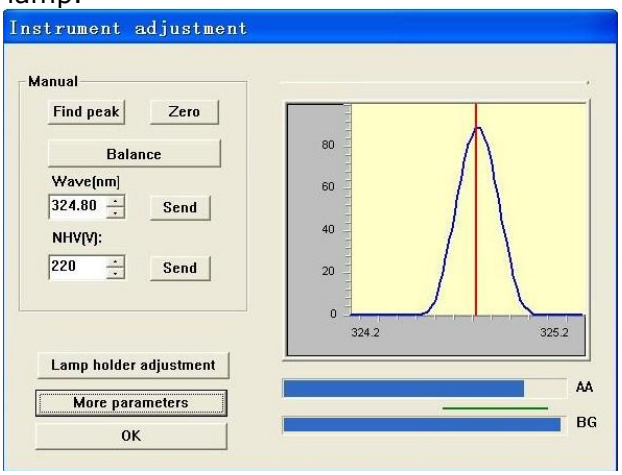


Figure 6-16

8. Press "Balance", and the screen will appear as shown in Figure 6-17.

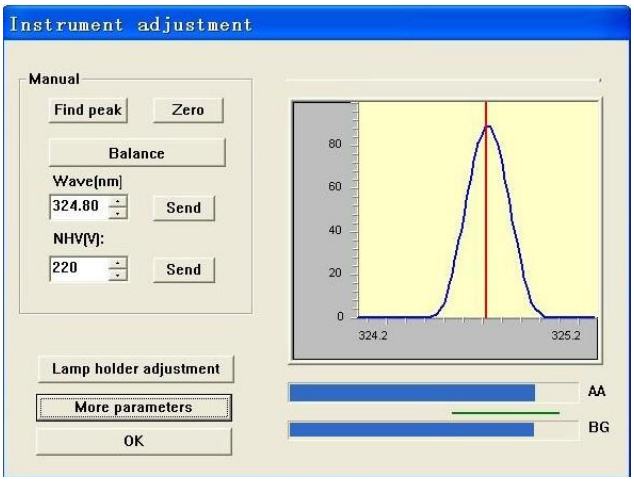


Figure 6-17

9. After the balancing is complete, press "OK" to close the dialog.

10. Select the desired testing method to conduct testing of the samples.

7

Calling Data

Calling Data

To call testing data files of qualitative analysis, you have to select a quantitative analysis mode first before opening a file.

1. Select "Call data" as shown in Figure 7-1. Alternatively, press the "Open" button on the toolbar. See Figure 7-2.

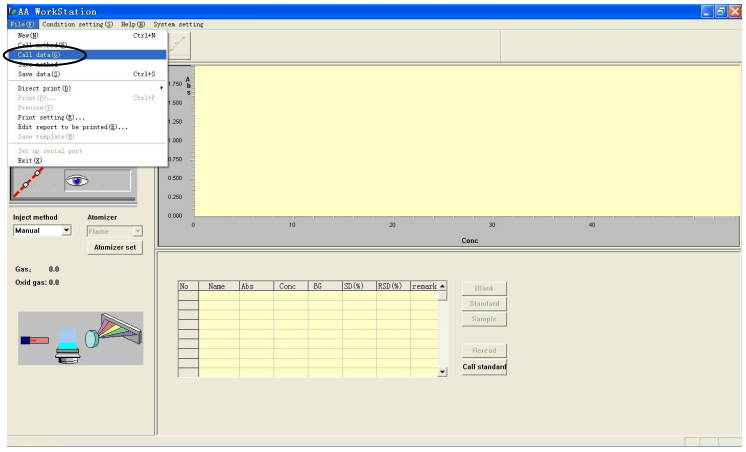


Figure 7-1

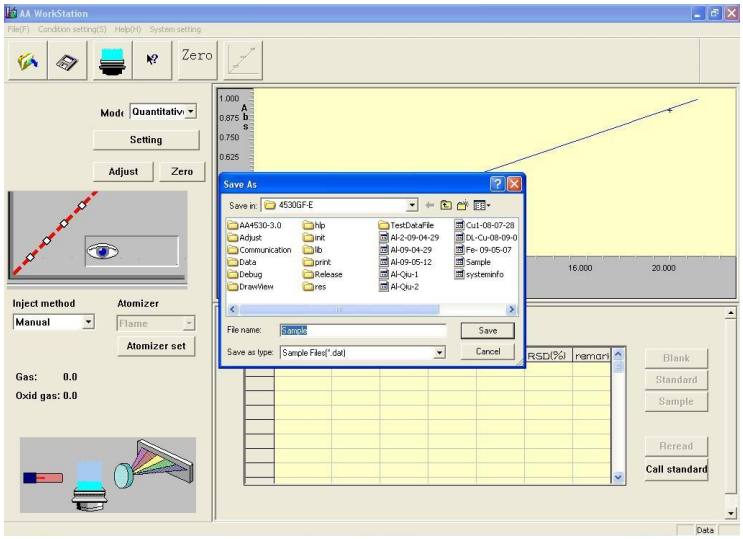


Figure 7-2

2. Select the file to be opened. Press "Open" to obtain the saved data, as shown in Figure 7-3, and then you can print the data.

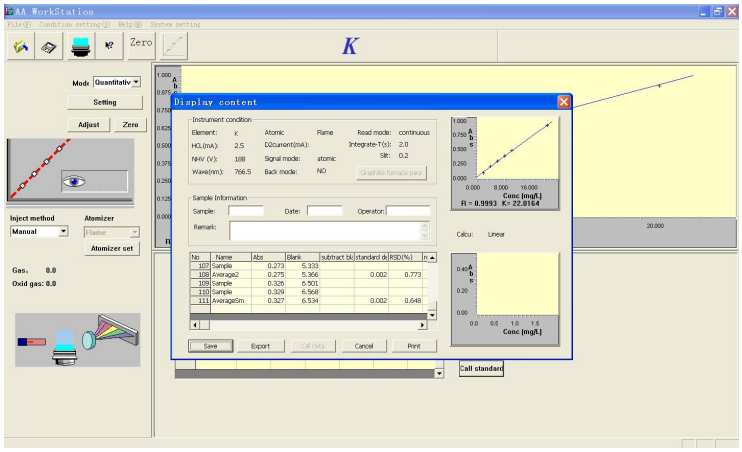


Figure 7-3

8

Setting Templates

Edit a Report to Be Printed

Edit a report to be printed according to the following steps:

1. Select "System information" in the "System settings" menu, as shown in Figure 8-1.

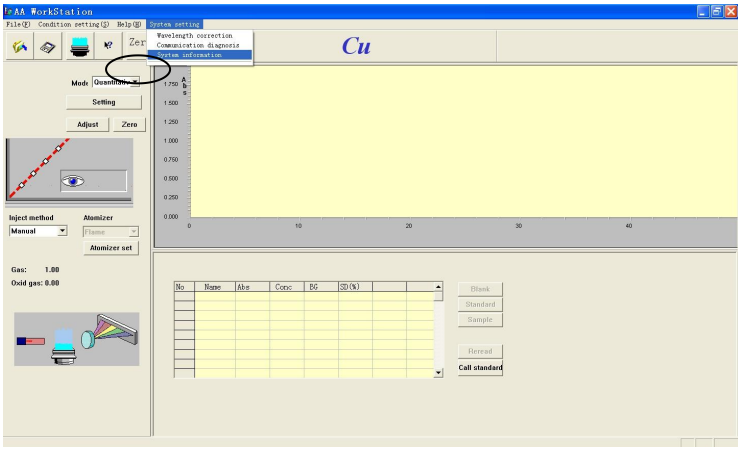


Figure 8-1

2. A dialog will appear, as shown in Figure 8-2. Enter corresponding information based on your needs.

Figure 8-2

3. After the necessary information has been entered, press "OK" to close the dialog.

4. Select "Edit report to be printed" in the "File" menu, as shown in Figure 8-3.

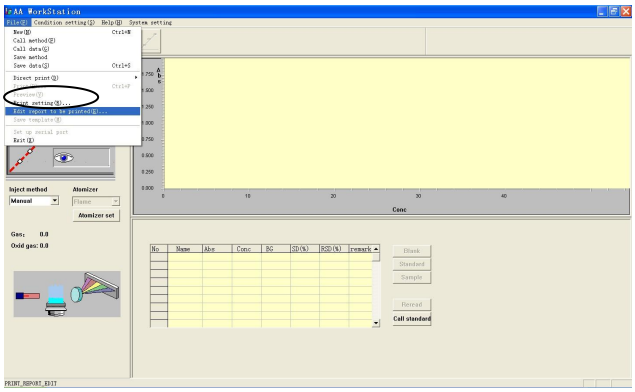


Figure 8-3

5. A dialog will appear as shown in Figure 8-4.(In the dialog, the fields of "Time scanning", "Wavelength scanning" and "Standard mode" correspond to the time scanning, wavelength scanning and quantitative analysis mode respectively)

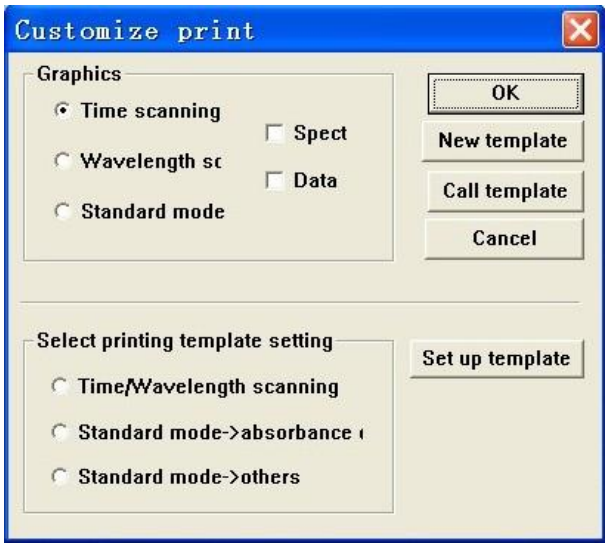


Figure 8-4

6. For example, to print the spectrum and data of time scanning, select "Time scanning", "Spectrum" and "Data", as shown in Figure 8-5.

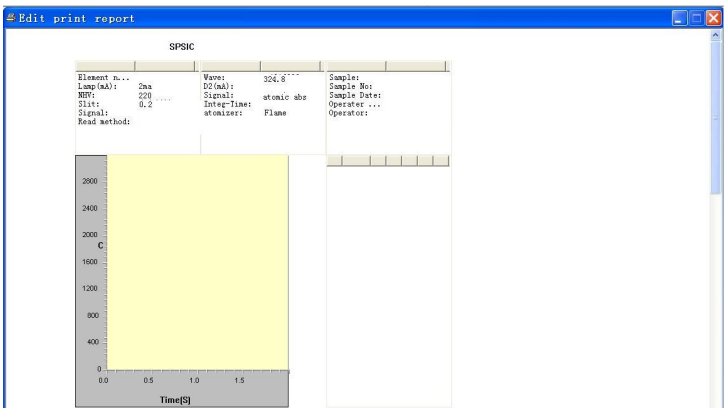


Figure 8-5

7. In the screen, you may move and zoom in and out based on your needs.

8. Then, select "Print preview" in the "File" menu as shown in Figure 8-7, and as the screen will appear as shown in Figure 8-8.

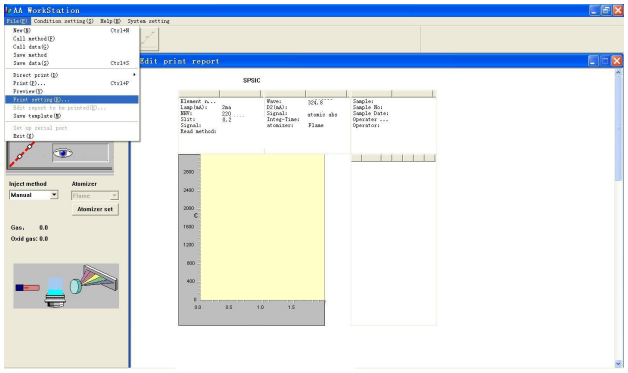


Figure 8-8

9. You may use functions available in the dialog.

10. Press the "Print" button when you are satisfactory with the edited report.

9

Wavelength Scanning and Time Scanning

Wavelength Scanning

(Attention: This mode is only used for testing the instrument.)

Generally, wavelength scanning is used to test the resolution of the instrument and check the emission line positions of light sources (hollow cathode lamps).

Take a Cu lamp for example, and lamp 1 is the one currently being used.

1. For light source correction, see "**Light source correction**".
2. After the light source correction is complete, press "More parameters" to show another dialog as shown in Figure 9-1a. Select "Emission", and press "OK" to close the dialog. The screen will appear as shown in Figure 9-1. Select "Wavelength scanning" in the "Mode" pull-down list.

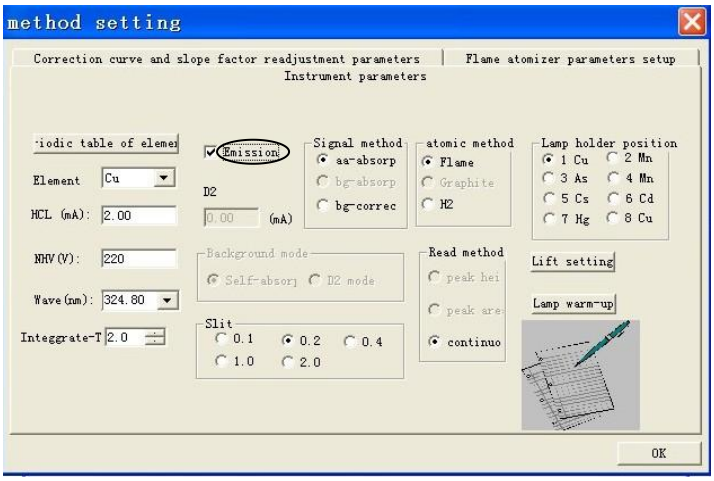


Figure 9-1a

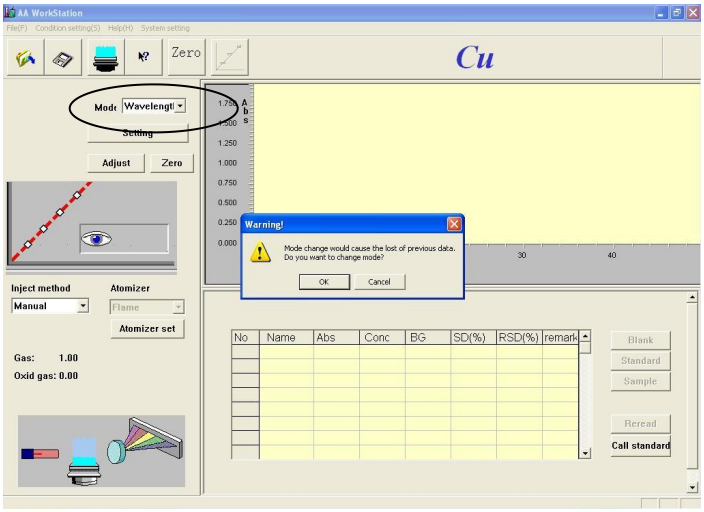


Figure 9-1

3. As shown in Figure 9-1, select "Wavelength scanning" in the "Mode" pull-down list, and a dialog will appear as shown in Figure 9-2.

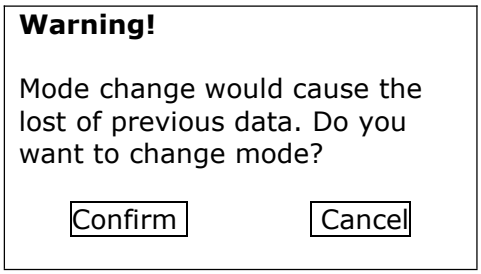


Figure 9-2

4. In the dialog as shown in Figure 9-2, press "OK" to select the wavelength scanning mode. The screen will appear as shown in Figure 9-3.

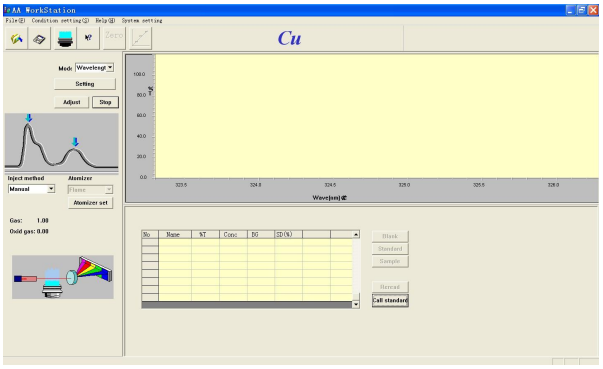


Figure 9-3

5. Press "Settings" to show the "Wavelength setup" dialog, as shown in Figure 9-4. The range of wavelengths is 190-900, and the ranges of scanning intervals are 0.01 and 0.1-1.0.

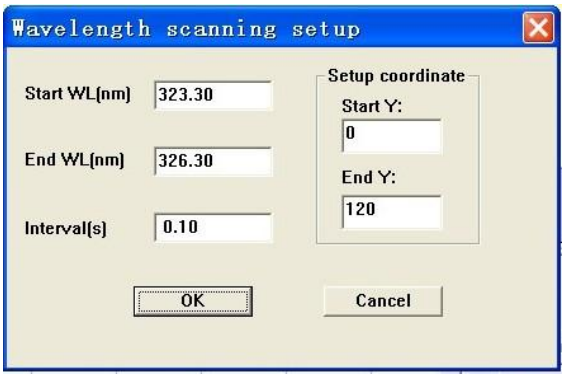


Figure 9-4

6. For example, set the range of wavelengths to be 300 - 350nm, the transmittance range to be 0-100%, and the scanning interval to be 0.1 s. Press "OK" to close the "Wavelength setup" dialog. Press "Start" to start scanning, and the spectrum will be shown in real time. See Figure 9-5.

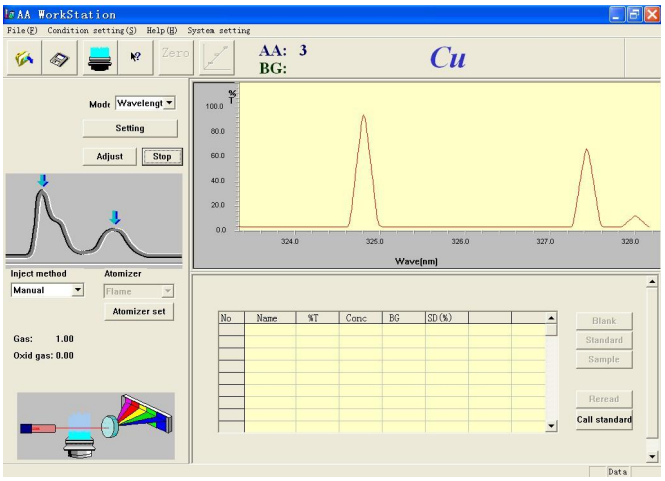


Figure 9-5

7. After the scanning is complete, you may resize the spectrum. Two methods are available for enlarging a section of curve.

   (1) Press and hold the left mouse key on the upper left part of the curve section to be enlarged, drag the mouse to include the entire section to be enlarged, and release the left mouse key. Now, the curve is enlarged.

   (2) To reset the X and Y coordinates, press the right mouse key in the spectrum area, and the screen will appear as shown in Figure 9-6. Set the coordinates as shown in Figure 9-7, and then the spectrum will be shown in the new coordinates. Continuously click for two times on an enlarged spectrum to restore the spectrum to the original size.

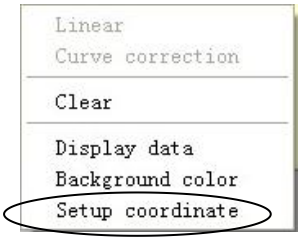


Figure 9-6

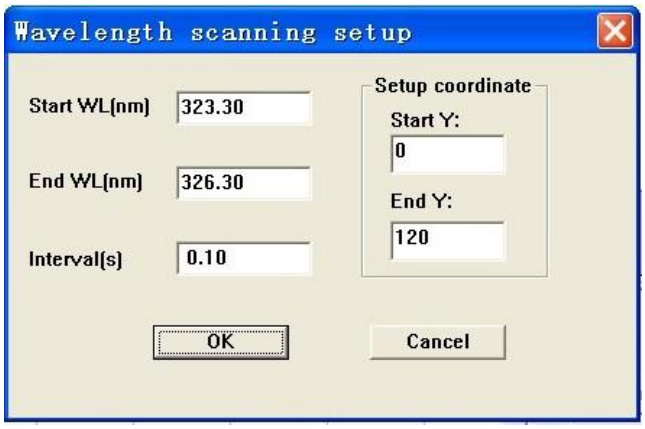


Figure 9-7

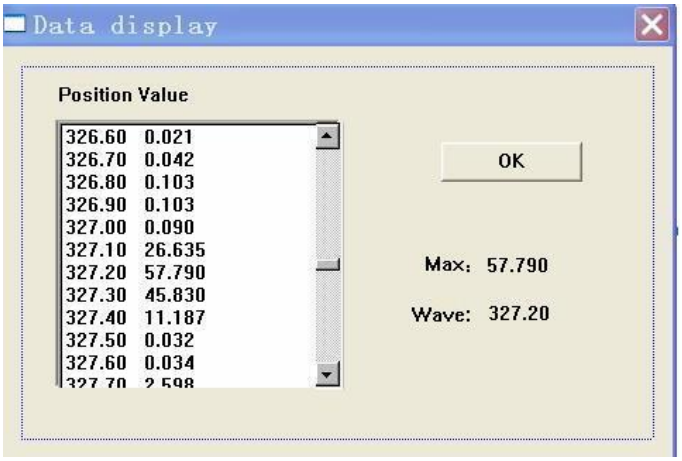


Figure 9-8

8. You can view scanning data during and after scanning. Press the right mouse key, and the screen will appear as shown in Figure 9-6. Select "Show data", and the screen will appear as shown in Figure 9-8.

9. Print: Select "Directly printing" in the "File" menu, as shown in Figure 9-9. If "Spectrum" is selected, the spectrum will be printed. Otherwise, the spectrum and data will be printed.

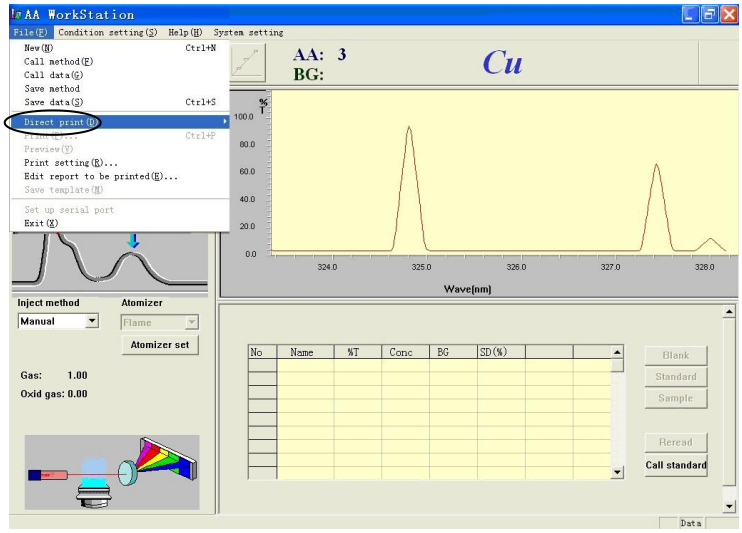


Figure 9-9

10. Call a spectrum: The methods are available for calling a spectrum:

    a) Press the "Open" button on the toolbar, as shown in Figure 9-10, and the "Open" dialog will appear, as shown in Figure 9-11. Enter the file name to be opened in the "File name" field, and press "Open" to obtained desired data.

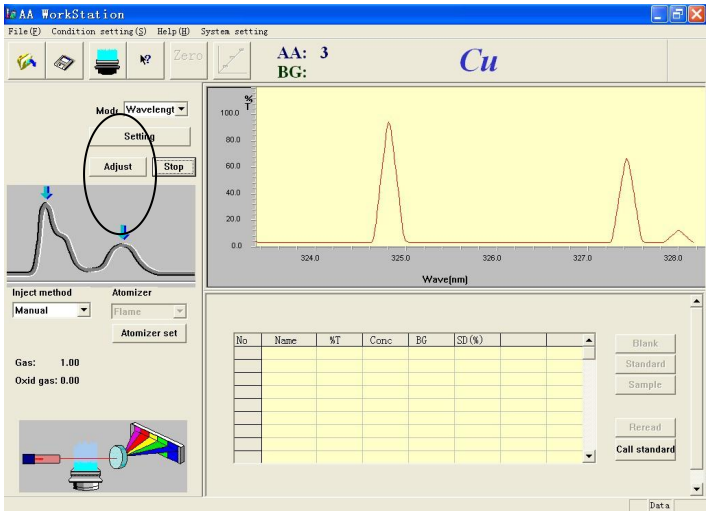


Figure 9-10

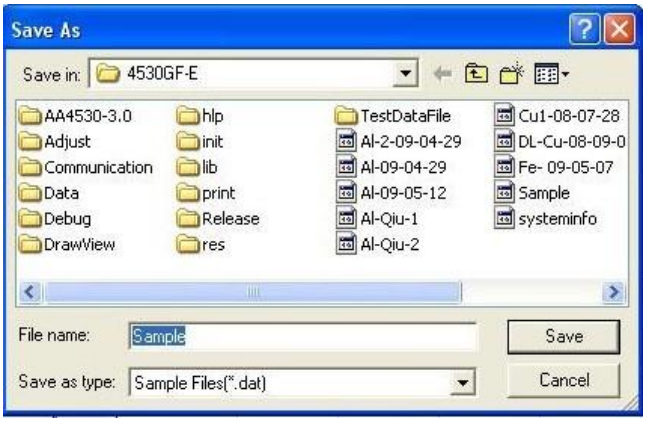


Figure 9-11

b) Select "Call data" in the "File" menu, as shown in Figure 9-12.A dialog will appear as shown in Figure 9-11.

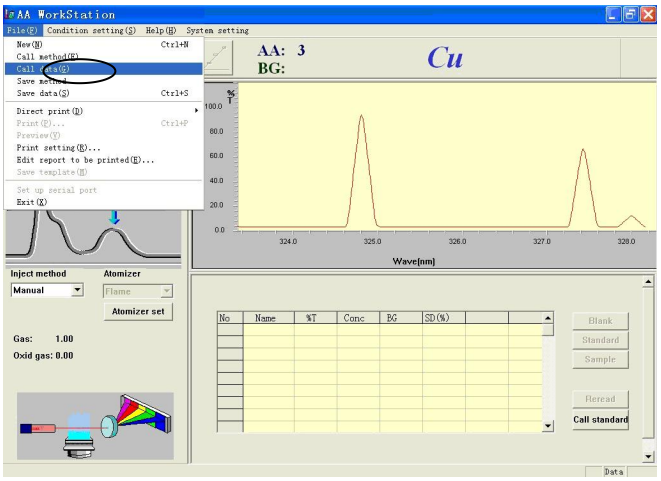


Figure 9-12

Time Scanning

The time scanning is usually used to test the static and dynamic baseline stability of the instrument.

Take a Cu lamp for example, and lamp 1 is the one currently being used.

1. For light source correction, see "**Light source correction**".
2. After the light source correction is complete, press "Zero" to zero the instrument, as shown in Figure 9-13.Press "OK" to close the dialog.

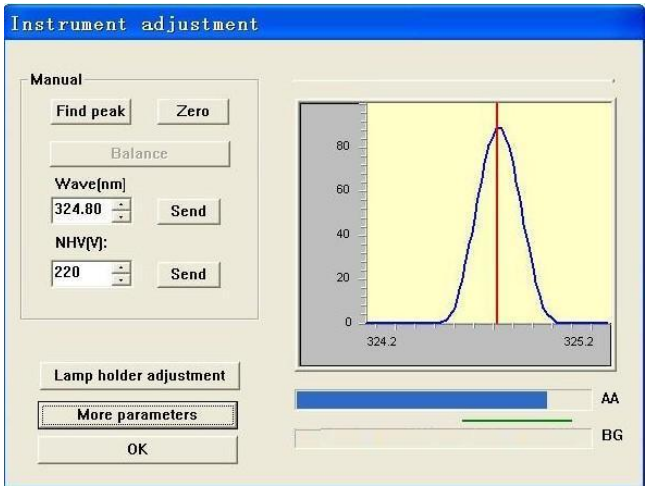


Figure 9-13

3. Select "Time scanning" in the "Mode" pull-down list, as shown in Figure 9-14.

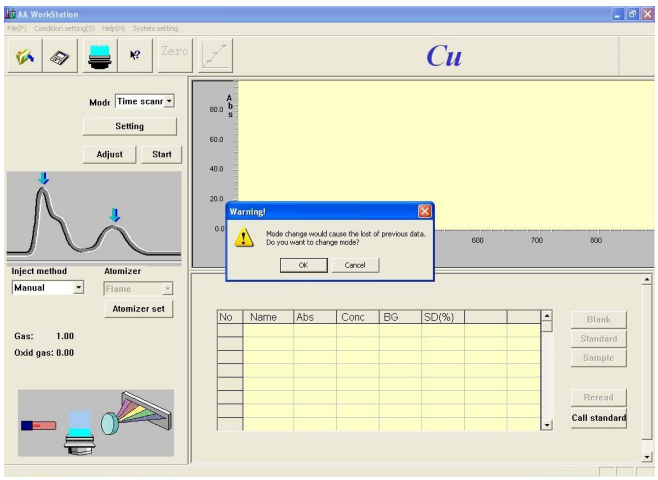


Figure 9-14

4. Press "OK" to confirm selection of the time scanning mode.

5. Press "Settings" to show the settings dialog, as shown in Figure 9-15. The unit of integration time is second; the unit of scanning time (X coordinates) is second; and the unit of absorbance values (Y coordinates) is (Abs).

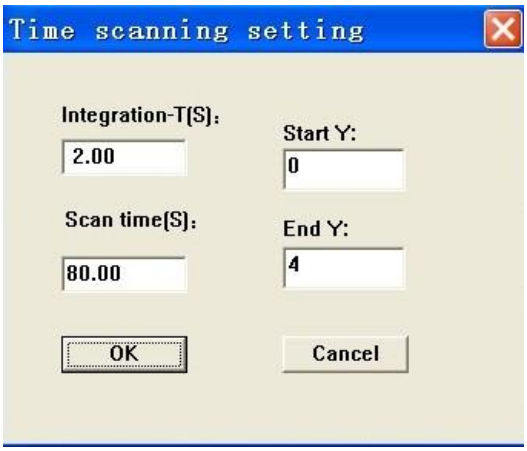


Figure 9-15

6. For example, to read very 10 seconds for 30 minutes, enter 10 in the "Integration time" field and enter 1800 in the "Scanning time" field. The X coordinates should be determined based on actual needs. For example, enter -0.005 in the "Start Y value" field, and 0.005 in the "End Y value" field. Press "OK" for confirmation and closing the dialog as shown in Figure 9-16a.

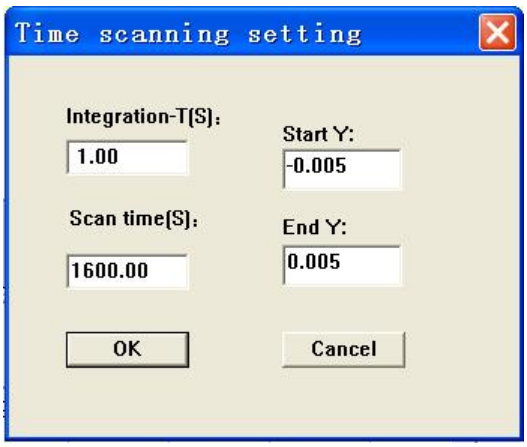


Figure 9-16a

7. Press "Start" to start time scanning (The "Start" button has been changed to the "Stop" button now). The spectrum and data is being shown in real time.

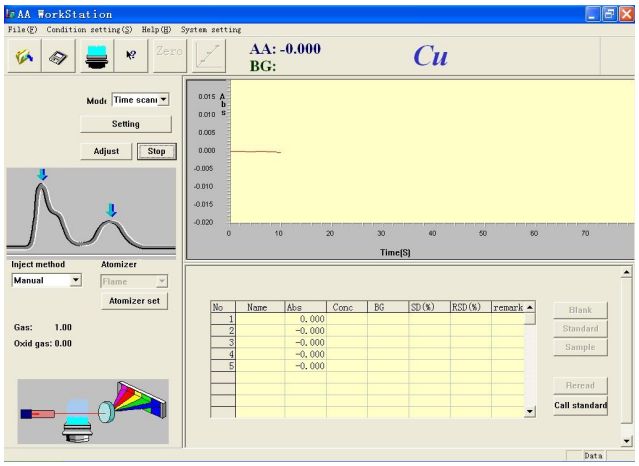


Figure 9-16b

8. You may stop time canning at any time during the scanning process. The scanning will be immediately stopped when the "Stop" button is pressed. Now, the "Start" button has been changed to the "Start" again.

9. The steps for viewing data and printing spectrums are the same as those for the "Wavelength scanning" mode.

4530F Atomic Absorption Spectrometer

Quality Certificate

Product No.:

This is to certify that the instrument has been inspected in accordance with the inspection procedures and has been found in compliance with the standard Q/YXWZ80.

Inspector:

Date:

4530F Atomic Absorption Spectrometer

Packing List

Instrument No.:

1. Instrument
2. Accessories (See the List of Accessories and Spare Parts)
3. Documents
   a) User Manual
   b) Quality Certificate

Date:

4530F Atomic Absorption Spectrometer

List of Accessories and Spare Parts

SN	Code & Model	Description & Specification	Qty	Unit
1	ASA1.670.802SM	User Manual	1	Copy
2	ASA1.670.803ZM	Quality Certificate	1	Copy
3	HPSF6.382.801	Burner (100mm)	1	Piece
4	HPSF6.385.807	Expansion chamber part	1	Piece
5	ASA8.940.831	Nut (Gas pipe connector)	8	Piece
6	SF8.210.030	Lining	8	Piece
7	SF8.215.065/12	Threaded bushing	8	Piece
8	SF8.370.206	Seal ring	8	Piece
9	SF8.370.350	Seal lining ring (part for acetylene cylinder)	4	Piece
10	SF8.402.900	Light check board	1	Piece
11	SF8.470.056	Connector of pressure reducing valve	1	Piece
12	SF8.470.113	Connector (leakage detection)	1	Piece
13	SF8.470.201	Input connector	1	Piece
14	SF8.470.202	Output connector	1	Piece
15	ASA8.811.800	Cover (dustproof)	1	Piece
16	04-01-580	O ring φ6×1.9	6	Piece
17	07-01-609	Polyvinyl chloride pipe φ8×11	3	Meter
18	07-06-011B	Polyvinyl chloride pipe φ6×4	20	Meter
19	20-14-010	O ring φ10×12	10	Piece
20	20-14-014	O ring φ14×2	6	Piece
21	20-14-032	O ring φ32×2.65	3	Piece
22	20-14-040	O ring φ40×2.65	3	Piece
23	20-17-008/012/017	Double open mind wrench 8×10,12×14,17×19	1 for each	Piece
24	20-17-050	2" screw driver	1	Piece
25	20-17-075	3" screw driver	1	piece
26	30-01-030	Fuse wire 0.5A	4	Piece
27	26-21-033	Fuse wire RF1-30 3A	3	Piece
28	31-01-020	VEKY-1 hollow cathode lamp Mn	1	Piece
29	31-01-080	VEKY-2 hollow cathode lamp Cu	1	Piece
30	32-02-140	Acetylene pressure reduction valve	1	Set
31	32-02-171	AAS-HPSF glass debulizer	2	Piece
32	32-04-139	HP printer	1	Piece
33	HPSF8.866.830	Guarantee Card	1	Copy
34	33-01-110	Water separation air filter (or air water filter) G1/4"	1	Piece
35	33-04-020	Air compressor	1	Piece
36	34-02-638	Power cord	1	Piece
37	20-23-004	Printing paper	500	Piece

38	34-02-660	RS232 communication cable	1	Piece
39	SF8.045.125	Piece	1	Piece
40	ASA7.000.800	Workstation software	1	Copy
41	SF9.026.008	Explosion protection spring	1	Piece