

# Routine Maintenance and Troubleshooting of the JSM- 5610LV Scanning Electron Microscope

Li Jianping, Yang Yongdong

( School of Optical and Information Science and Technology, Yantai  
University, Yantai 264005, Shandong)

**Abstract:** In the daily maintenance of scanning electron microscope, we should control the environmental factors in the room, keep the electron microscope in a high vacuum state for a long time, and regularly check whether the attached equipment meets the requirements. The troubleshooting methods of the electron microscope, such as dead, black screen and abnormal image display, are introduced.

**Keywords:** scanning electron microscope; routine maintenance management; troubleshooting

CICS: TN 16

Document ID: A

Article ID: 1006-3757(2008)02-0125-02

With the development of science and technology, the application of electron microscope is becoming more and more widespread, which plays a great role in promoting the technological revolution, especially the development of nanotechnology, but the electron microscope is sophisticated and expensive, which requires special knowledge of management, use and maintenance to ensure that it is in normal working condition and better serve the scientific research and production. This paper briefly discusses the routine maintenance and troubleshooting of the JSM-5610LV SEM of Japan Electronics.

## 1 Daily maintenance

(1) Keep the electron microscopy room clean and dust-free, and control the environmental

factors in the room by means of air conditioning and dehumidification, so that the room temperature is between 15 and 25 and the humidity is below 50%.

(2) Keeping the electron microscope under a certain vacuum for a long time, the vacuum level

Generally required above  $10^{-5}$  Torr<sup>[1]</sup>. 既是电镜在工作期间, Also evacuate regularly, 雨季里 5 d 抽一次, 其它季节 7 d 抽一次, 以防电镜镜筒及能谱仪内部元器件锈蚀.

(3) Check the oil level of the mechanical pump (DP) frequently to see if the level is at the level of the window oil level mark, if it is below the level of the window oil level mark, add mechanical pump oil immediately, if the mechanical pump window oil is observed to be teal, replace the mechanical pump (DP) oil immediately.

(4) Change the diffusion pump (RP) oil in

the electron microscope regularly<sup>[2]</sup>.

( 5) Periodically clean the movable diaphragm, sample stage, electron gun chamber and other contaminated parts in the mirror barrel to ensure the proper operation of the electronic optical circuit. When cleaning, the diaphragm is cleaned by heating with a vacuum sprayer, and the sample stage and electron gun chamber are cleaned with a mixture of alcohol and acetone 1:1 with a cotton ball.

( 6) Regularly check the condition of circulating water, the water level is below the warning line, should immediately add pure water, if the circulating water is cloudy and deteriorated, should immediately replace the circulating water to prevent the circulating system clogging and scaling, affecting the efficiency of the water circulation system.

( 7) Periodically turn on the backscattered electron imaging system, composition imaging system, topography imaging system, stereo imaging system and other functional systems that are not commonly used in electron microscopy to prevent the deterioration of electrical components. The turn-on time should not be less than 1 h.

( 8) Regularly check the X-ray leakage of the electron microscope and strengthen the protection measures to ensure personal safety.

## 2 Troubleshooting of common problems

When there is a fault in the electron microscope, the first thing to do is to determine the general part or cause of the fault, then check it step by step to minimize the scope of the fault, and finally find out the cause of the fault or the specific component, and then solve the problem. The following are some common troubleshooting methods for the JSM-5610LV SEM.

### 2.1 Failure 1

Fault phenomenon: The screen displays the image, but the image is shaky, blurred, and the upper and lower lines are not clear.

Cause: There are many reasons why the image may be unclear, in this case During operation, the Dynamic Focus Correction function was inadvertently activated, and the electron microscope generated alternating magnetic fields, causing focal jitter and blurring of the image. [3], 且上下隔行不清晰.

Solution: Turn off the Dynamic Focus

Received: 2008-03-14;      Revision date: 2008-04-16.

Author Biography: Jianping Li ( 1963- ) , M, College, Lab, Main research interests scanning electron microscope.

## 2.2 Failures 2

Fault phenomenon: Dead, focal length, magnification and other function keys are not working, especially the power switch of tungsten lamp of the electron microscope OH / Ready can not be turned off.

Reason: The procedure of electron microscopy is not smooth due to the misuse of the magnification, such as adjusting the magnification too fast.

Solution: Turn off the electron microscope, restart it.

## 2.3 Failures 3

Fault: When the electron microscope is turned on and pressurized, the screen does not display the image!!! Black screen.

Cause: The filament is burnt out and not energized or the brightness and contrast of the screen display is not appropriate<sup>[4]</sup>.

Solution: First open the Gun icon, check the tungsten filament<sup>[5]</sup> (whether it is energized or not), if it is not energized, it means the tungsten filament is burned, then replace the filament; if it is energized, adjust the contrast and brightness until the image is sharp and clear.

## 2.4 Failures 4

Fault: The Z-axis display of the electron microscope sample stage is zero, and automatic functions such as AFC, ACD and AST cannot be performed.

Cause: The A/D converter MP8775AN of the EOS board of the electron microscope is not functioning properly, the automatic function cannot be implemented, and there is no output from the Z sensor.

Solution: Replace the A/D converter MP8775AN on the EOS board of the electron microscope.

## 2.5 Failures 5

Fault phenomenon: When the SPOT SIZE value is set to 16, the displayed image is normal; when the SPOT SIZE value is set to more than 17, the displayed image is shaky and accompanied by

Discharge phenomena.

Cause: The tungsten filament of the electron microscope is about to burn out, the current through the tungsten filament is out of adjustment<sup>[6]</sup>,从而激发出来的电子不稳定,当 SPOT SIZE is set to a value greater than 17 时,初级磁透镜对电子束进行汇聚也就不稳定,进而影响成像效果.

Solution: Replace the tungsten filament of the electron microscope and make a series of adjustments such as alignment.

### 3 concluding remarks

A high degree of responsibility, routine maintenance and troubleshooting skills are the basic requirements for electron microscope operators. Only by doing these things can we make better use of the electron microscope and serve the

scientific research.

Reference:

- [ 1 ] Ma JX ,Zhu GK. Introduction to scanning electron microscopy [ M ].Beijing: Science Press, 1985. 62.
- [ 2 ] Zhu Y. Routine maintenance and troubleshooting of electron microscopes [ J ]. Inside Mongolia Petrochemicals , 2000, ( 3 ) : 83.
- [ 3 ] Zhu Zufu .Electron microscopy [ M ]. Beijing: Mechanical Industry Press,1984. 56.
- [ 4 ] Li Jianping. General troubleshooting of the JSM-5610LV scanning electron microscope [ J ]. Instrument User, 2007, 14( 3 ) : 146.
- [ 5 ] Wang Hazheng ,Li Yusheng . Modern analytical instrument maintenance manual [ M ].Beijing : Aviation Industry Press, 1988. 415.
- [ 6 ] Liu Yuehua ,Xu Yanping . Four cases of JSM-T 300 scanning electron microscope repair [ J ]. Journal of Electron Microscopy, 1998, 17( 5 ) : 672-673.

## Daily Maintenance and Familiar Faults Clearance of JSM-5610LV

LI Jian-ping , YANG Yong-dong

( Institute of Science and Technology

for Opto-Electronics Information, Yantai University , Yantai 264005, China)

Abstract: During the daily maintenance and management of SEM , we should better control the factors of the indoor environment and keep the interior of SEM. Finally, the methods of fault clearance such as halt, black screen and image show abnormality of SEM is introduced in this paper.

Key words: SEM ; maintenance and management; fault clearance

Classifying number: O 657. 32