

A User Guideline to Aberration-Corrected STEM in MCPF

1. Instrument Model:

JEOL JEM-ARM200F aberration-corrected scanning transmission electron microscope (STEM)

2. Functionality:

a. Atom-resolved Imaging under STEM Mode and different accelerating voltages as shown in the table below (conventional transmission electron microscope (TEM) mode is also available);

Accelerating Voltage	200kV	80kV	60kV	30kV
STEM	0.083 nm	0.136 nm	0.136 nm	0.192 nm
TEM	0.224 nm	Not Guaranteed		

b. Energy-dispersive X-ray spectroscopy (EDS) with JEOL dual dry wide-area silicon-drift detectors, which features unprecedented efficiency and high spatial resolution (mapping resolution dependent on samples and experimental conditions);

c. Electron energy-loss spectroscopy (EELS) with GATAN Enfium spectrometer (extreme energy resolution can be down to 0.4 eV and dual EELS mode is available);

d. Tomography and 3D Reconstruction under both TEM and STEM modes (resolution depends on samples and experimental conditions down to few nanometers).

3. Sample Requirements:

a. Materials containing biological, organic or ferromagnetic (e.g. Fe, Co, Ni, etc.) substances are forbidden;

b. Samples must be prepared at least one day before their sessions for evaporating possible liquid residue or stabilization;

c. Samples should be clean, robust and will not evaporate, react or crack to cause column contamination (e.g. gas or particles) under electron irradiation;

d. As-prepared TEM samples, which are to be used in the aberration-corrected STEM sessions, are required to be characterized in advance by a high resolution TEM to locate areas of interest first. The user needs to submit a report by mail to justify necessity and objectives of characterization by this aberration-corrected STEM together with the TEM images showing the areas of interest.

e. Materials Characterization & Preparation Facility (MCPF) reserves all rights to reject any samples or experiments which are considered to hold harmful possibilities to the machine or in occasions where the experimental objectives cannot be achieved practically.

4. Procedures:

- a. As required above, before applying for an aberration-corrected STEM session, users should examine their as-prepared TEM samples, which are the ones to be used in their aberration-corrected STEM sessions, using a high TEM (e.g. JEOL JEM-2010F or JEM-2010 in MCPF) to locate areas of interest and justify necessity and objectives of their aberration-corrected STEM characterization.
- b. Users should submit an application form (as attached in the appendix of this guideline) clarifying their samples' information, justifying their characterization purposes, together with the TEM images showing the area of interested. MCPF will respond to complete application only and contact applicants within five working days about their session arrangements;
- c. For successful application, users will be allocated into aberration-corrected STEM sessions according to available time slots. Then users should hand in their samples to MCPF at least one day before their sessions, so that the samples can be loaded into the dedicated pumping station in advance for gas desorption and loaded into the aberration-corrected STEM before sessions for stabilization of holder drifting;
- d. The characterization results will depend greatly on the sample conditions (e.g. the sample preparation, the robustness against electron irradiation, etc.) and MCPF will not guarantee the accomplishment of user objectives;
- e. MCPF reserves all rights to cancel an allocated session if users cannot comply with the regulations stated above. In the case where users fail to cancel their booking at least 24 hours before their sessions and do not show up in time, MCPF will still charge the equipment fees as a penalty.

5. Session Arrangements:

- a. A session includes three hours and there are normally two sessions a day from Monday to Thursday every week except holidays. Fridays will be kept for routine maintenance (e.g. routine alignments of electron optics and refinements of the aberration corrector up to the fifth order). Details are as shown in the timetable below;

Working Days	Monday	Tuesday	Wednesday	Thursday	Friday
Session 1 (09:30-12:30)	Open for Booking				Routine Maintenance
Session 2 (14:00-17:00)					

- b. The first Wednesday and Thursday every month except holidays will be kept for baking out the machine.
- c. One user can only apply for one session per week.

6. Charge:

User Types	HKD per hour
Internal Users*	400
Members of the CRF project of aberration-corrected STEM facility from Sister Institutions	800
UGC-funded users from Sister Institutions	1000
Non-UGC-funded users from Sister Institutions and other external Users	3000

- a. Internal Users refer to present faculties and staff in the Hong Kong University of Science & Technology.
- b. The minimum charging is for one session even if users finish their experiments before the end of their session time. a. Internal Users refer to present faculties and staff in the Hong Kong University of Science & Technology

7. Acknowledgement:

Please acknowledge the support of the aberration-corrected TEM characterization facility and the CRF project (project no. C6021-14E) in MCPF of HKUST in your publications or presentations.

Example: ***“The TEM characterization of this research work was carried out on JEOL JEM-ARM200F aberration-corrected TEM (project no. C6021-14E) in Materials Characterization and Preparation Facility, the Hong Kong University of Science and Technology.”***