

Policy document for Electron Microscopy Center

Background

The Department of Materials and Environmental Chemistry (MMK) has a unique set of advanced transmission and scanning electron microscopes including sample preparation instruments. It is important that these instruments are used in an effective way and that they are easy to be accessed for researchers both from groups inside Stockholm University (internal users) as well as from other universities or academic institutes (external academic users) and companies (external company users). The microscopes are very sensitive instruments and therefore a strict system/regulation how to use them and how to introduce and train new user is needed to keep them in perfect status. Furthermore, the running costs are significant and the users have to share the costs necessary for maintain them.

To secure and promote the use of instruments of this kind the Faculty of Science at Stockholm University has decided to give financial support to the Electron Microscopy Center (EMC) at MMK. This document is written to inform how to get access to the electron microscopes at MMK.

Access

New users who want to use the microscopes should contact one of the following persons in the Electron Microscopy (EM)-committee: Prof. Gunnar Svensson, Prof. Xiaodong Zou, Prof. Aji Mathew, Dr. Anumol Ashok, Dr. Kjell Jansson and Dr. Cheuk-Wai Tai. They will then organise how the access should be achieved and give priority between the projects. There are three levels of access to the instruments;

- 1) Short-term studies with operator
- 2) Long-term studies with operator
- 3) Long-term studies without operator.

In this context the operators are normally Kjell Jansson for scanning electron microscopy (SEM) and Anumol Ashok and Cheuk-Wai Tai for the transmission electron microscopy (TEM), if not others are stated. In addition, Tom Willhammar and Jiaoyan Xu are working part-time for EMC. Members in the EM-committee should sanction the use of other operators.

The short-term studies are intended for researchers who need help with minor electron microscopy studies or do not have the competence within their group to perform the study. It also includes so called test runs to check if electron microscopy is a feasible technique. Short-term studies encompass up to 2 sessions per year.

Long-term studies are extensive studies with repeated sessions at the microscopes. Since the time available for Kjell Jansson, Anumol Ashok and Cheuk-Wai Tai is limited it is necessary

Institutionen för material- och miljökemi

to discuss these studies with Gunnar Svensson. 40% of their time is allocated for short term and long-term EM-studies. In addition, Tom Willhammar and Jiaoyan Xu are available (15% of full-time each during 2021) for short- and long-term studies. The chair of EMC, application specialist and group leader will meet to make a time plan. The EMC-committee will make priority lists between such projects. For the SEM instrument and the soft matter sample preparation all there the same priority is given for external as internal users. For TEM studies internal users from SU and those through ARTEMI have the highest priority.

Long-term studies without operator are when the research group has a person with competence for the EM or have collaboration with a researcher inside SU with such competence. However, it is very important that the responsible persons for the EM-laboratory are informed about this arrangement, especially when external researchers are involved.

EMC has facilities for sample preparation mainly for particles and soft materials, see homepage and instrument fees below. For the latter Anumol Ashok is the contact person for the ultramicrotome while for preparation of SEM samples under cryogenic condition (slush cooling, coating and cryogenic cross section polishing) both Anumol and Kjell will be contact persons.

Finally, it should be noted that electron microscopy is such a broad scientific field that the researchers at MMK do not cover every technique in detail. This means that for some more advanced techniques the researcher has to get the competence from outside MMK. This can be advantageously done through ARTEMI (<https://artemi.se/>), a VR-supported national infrastructure with a mission to provide advanced TEM studies. EMC is part of ARTEMI and EMC's staff is happy to help you find your way in ARTEMI. EMC is also a member of the regional EM network CEM4MAT with the goal to increase the collaboration and accessibility in the Stockholm region, but others are also welcome.

Acknowledgements and Publication – Your use of EMC facilities is heavily subsidised by Department of Materials and Environmental Chemistry and Faculty of Science, Stockholm University and by grants from external funding agencies. EMC has the obligation to report on the publications produced by our users of the Center. Therefore, the users should provide the publications and reports in which the results obtained using EMC facilities, including instruments, computer software and staff advice. In the publication or report, EMC and any assistance provided by EMC staffs should be acknowledged. EMC staffs, who acquired and/or interpreted the results, should be invited to be co-authors of the publication. For co-authorships the policy follows the Vancouver recommendations for co-authorship (<https://innsida.ntnu.no/wiki/-/wiki/English/Co-authorship>). If EMC staffs' contribution is not enough to justify co-authorship, the acknowledgement in the publication should be: “The authors acknowledge the use of the EM facilities and the assistance of (NAME of STAFF) at Electron Microscopy Center at Stockholm University”. If our Themis Z microscope was used, the acknowledgement should be “This work was performed, in part, at the Electron Microscopy Centre, supported by the Department of Materials and Environmental Chemistry

and Faculty of Science at Stockholm University, Sweden”. If JEOL JSM 7000F, 2100LaB6 and/or 2100F microscope was used, “The Knut and Alice Wallenberg Foundation is gratefully acknowledged for an equipment grant (KAW 2003.0198) for the electron microscopy facilities at Stockholm University.” should be included in the publication or report. If JEOL IT-800 microscope was used, the acknowledgement “The Swedish Science Council is gratefully acknowledged for the research infrastructure grant (project number: 2021-00318) for the electron microscopy facilities at Stockholm University.” should be included in the publication or report. The publication reference should be sent to Anumol Ashok. EMC would appreciate if a soft copy of the publication can be provided. It will be displayed in the Center.

Training of new users

At the EM laboratory there are at present three scanning electron microscopes and three transmission electron microscopes. Learning the operation of an electron microscope demands a great deal of time and commitment, especially transmission electron microscope. The course “Electron Microscopy for Materials Characterization (KZ7016)” or equivalent (theoretical self-studies using a suitable book in transmission electron microscopy and instruction films on internet are an option) is a prerequisite. It is important that the EM instruments are run after the same protocol. All new users will therefore be given the basic training in how to run the microscopes. The extra instrumentation/accessories on SEM and TEM make the number of possible studies numerous and the user will need special training for each technique. The user can be experienced when it concerns microanalysis of particles in a TEM but not necessary being qualified to run EELS/EFTEM or STEM. It should also be noted that to learn basic SEM approximately 5 full days are required, while the basic TEM (imaging and selected-area electron diffraction) with EDS typically takes 10 full days. To learn additional techniques like basic scanning transmission electron microscopy or basic electron energy loss spectroscopy additional training periods are needed.

SEM training

A person who wants to be trained in SEM should fill in the special form provided by Kjell Jansson. He and to some extent also Anumol Ashok continually trains new users for the SEM, acts as adviser for trained users, helps other research groups and provides service to the microscopes. As his time is limited, therefore each research group, which has a need for repetitive SEM studies, should have at least one member with access to the microscopes. This includes research groups outside MMK at SU. However, this cannot always be fulfilled immediately due to time limitations.

TEM training

A person who wants to be trained in TEM should fill in the special form provided by Anumol Ashok or Cheuk-Wai Tai. The applicant will then be contacted. The training of new TEM users demands a great deal of time. It is therefore necessary to make priority lists. However, it is the intention that each research group, which has a need for repetitive TEM studies, should have at least one member with access to the microscopes. The training of new users will

mainly be taking care of by Anumol Ashok and Cheuk-Wai Tai. It is also possible to get trained by one of the senior users after discussing with the EM-committee. The training will be more efficient if the adept prepares the sessions with intensive studies of relevant literature and instruction films on internet.

Samples

SEM and TEM instruments are very sensitive and some samples are not suitable to put in the microscopes. Special care should be taken with samples, which could be suspected to be magnetic or contain organic or other volatile substances. It is therefore obligatory to consult Kjell Jansson for SEM or Anumol Ashok and Cheuk-Wai Tai for TEM before first putting a new type of sample in the microscope.

Costs

There are three levels of fees: *internal*, *external academic* and *external company users*.[†] Long term users from outside Stockholm University are recommended to contact Gunnar Svensson to write a contract.

Students and staff members employed or associated with SU pay the *internal user fee*. No additional fee is needed for training. However, if the user does contract research paid or subsidised by a company, the *external non-academic user fee* is applied and the *operator fee for the external user* is additionally charged for the training.

MSc/PhD students and researchers from other universities/academic institutes pay the *external academic user fee*. The *operator fee for external academic user* is applied when the training is needed. However, if the user does contract research paid or subsidised by a company, the *external company user fee* is applied and the *operator fee for the external company user* is additionally charged for the training.

All non-academic users pay the *external company user fee* for running the microscope or equipment. The *operator fee for the external company user* is additionally charged for the training.

Electron microscopes

The electron microscopes, except SEM TM-3000, are booked in 4 hours session. The operator normally needs at least one hour before and one hour after the session to prepare and sum up

[†] Value added tax (VAT) is not included in the fees listed.

the work. External service jobs will be accepted based on availability of the instruments and operators. Fees are given by SEK/hours.

Instrument	Internal users		External academic		External Company	
	Instrument fee	Operator ii, iii	Instrument fee	Operator ii, iii	Instrument fee	Operator ii, iii
SEM – JSM 7000F	275	350	1000	1100	1300	1400
SEM – JSM IT800**	350	350	350	1100	1300	1400
SEM – TM-3000 ⁱ	200	350	350	1100	1000	1400
TEM – JEM 2100 LaB6	400	350	1000	1100	1300	1400
TEM – JEM2100F	400	350	1000	1100	1500	1400
TEM – Themis Z	1050	350	2100	1100	3100	1400

ⁱ⁾ Can be booked on hourly basis.

ⁱⁱ⁾ Additional time for start-up and close down may be needed.

ⁱⁱⁱ⁾ For access through ARTEMI the operator fee is covered by VR-RFI/SSF.

^{iv)} JSM – IT800 is a national infrastructure supported by VR-RFI. Therefore, instrument fees for internal and external academic fees are the same.

Fees for sample preparation, SEK/h

Instrument	Internal users		External academic		External Company	
	Instrument fee	Operator#	Instrument fee	Operator#	Instrument fee	Operator#
Ion-milling	350	350	400	1100	2000	1400
Ion Slicer	350	350	400	1100	2000	1400
Cryo Cross Section Polisher ⁱ	70	350	70	1100	200	1400

Carbon sputter	Costs for consumables	350	Costs for consumables	1100	Costs for consumables	1400
Gold sputter	Free of charge	350	Free of charge	1100	Free of charge	1400
Polishing paper, sample cutter, TEM grids, etc.	Cost for consumables		Cost for consumables		Costs for consumables	1400
Ultra microtome ⁱ	120	350	120	1100	550	1400
Cryo-prep. ⁱ	70	350	70	1100	150	1400
Vitrobot	Free of charge	350	Free of charge	1100	Free of charge	1400

Additional time for start-up and close down will be needed.

ⁱ) National infrastructure supported by VR-RFI. Therefore, instrument fees for internal and external academic fees are the same.

How to pay

Internal users at MMK

Research groups inside MMK will be charged on their fees four times per year.

Internal users from departments other than MMK inside SU

- Short-term studies will be debited when the study or test is completed. The first 2 sessions for a research group will be paid by the “Core facility EMC”
- Long-term studies with and without operator will be debited four times per year.

External academic and external users outside Stockholm University (other universities, institutes, industry...)

- Short-term studies will be debited when the study is completed.
- External users who want long-term studies are recommended to write a contract with MMK.
- External users who want long-term studies are recommended to write a contract with MMK.

Contact person

Prof. Gunnar Svensson E-mail: gunnar.svensson@mmk.su.se Tel: 08-164505