User rules of the TEM laboratory

at the Institute of Materials Science of the TU Bergakademie Freiberg

(Version November 2024)

§1 Introduction

The Institute of Materials Science at the TU Bergakademie Freiberg (IWW TU BAF) operates a high-resolution analytical transmission electron microscope (TEM) JEM-2200FS (JEOL, Japan). The TEM, the equipment for the TEM sample preparation and the expertise of the Chair of Structure and Microstructure of Materials in the fields of the structure and microstructure analysis of metals, ceramics, composites, hard materials and semiconductors are available for the institutes of the TU BAF and for external cooperation partners. The user rules summarized below are obligatory for all users.

§2 Instrumentation

The TEM JEM-2200FS is equipped with a field emission gun (Schottky emitter) and can be operated alternatively at the acceleration voltage of 200 kV or 80 kV. Further functional components of the microscope are:

- Cs corrector (CEOS GmbH) in the illumination system for the correction of the spherical aberration of the condenser lens,
- Ultra-high-resolution objective lens (Cs = 0.5 mm),
- In-column omega filter for the energy filtering and for the electron energy loss spectroscopy,
- High-resolution CCD camera or image plates,
- EDX detector,
- Bright-field (BF) detector,
- Annular dark-field (ADF) detector,
- High-angle annular dark-field (HAADF) detector,
- Single-tilt and double-tilt holders, as well as a sample holder for electron tomography.

The point resolution of the microscope (at U_A = 200 kV) is 1.9 Å in conventional mode (CTEM) or 1 Å in scanning mode (STEM). Further information can be found at https://tu-freiberg.de/fakult5/iww/technical-equipment-institute-materials-science/electron-microscopy/jeol-jem-2200fs.

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This TEM equipment enables analyses of the structure and microstructure of materials using:

- Bright and dark field imaging in both CTEM and STEM modes (HRTEM, HRSTEM, HAADF-STEM),
- Electron diffraction with parallel or convergent primary beam (SAED, NBED, CBED),
- X-ray and electron spectroscopies (EDX, EELS).

§3 User groups and operating modes

The instrument is used primarily by the institutes of the TU BAF, and additionally within the framework of the collaborations between the Institute of Materials Science and external cooperation partners. The TEM is utilized either in the application mode or in the service mode.

In the application mode, users instructed by the head of the TEM laboratory are allowed to work on the microscope independently. They get technical and scientific support through the staff of the Institute of Materials Science. In the service mode, the TEM analyses are carried out by the employees of the Institute of Materials Science. The assignment of the users to the respective category is in the responsibility of the head of the Chair and of the head of the TEM laboratory.

§4 Booking and assignment of usage periods

The usage of the instrument is granted to the user groups listed under §3. It always prerequires a usage requests that shall be submitted to one of the contact persons (see below) or via the online booking system that is located at https://tu-freiberg.de/fakult5/iww/technical-equipment-institute-materials-science/electron-microscopy/jeol-jem-2200fs. In the case of the TEM overbooking and in the case of other conflict situations (scheduling of the measuring time), the head of the Chair and the head of the TEM laboratory decide on the prioritisation.

The periods of use are registered in a logfile, which is also used for the calculation of the costs and for accounting. The billing regulations are given in the appendix.

§5 Responsibility

All users of the TEM laboratory are obliged to follow the user regulations and to refrain from doing anything that could disturb the operation of the equipment. Users are responsible for damage caused by an improper use of the TEM laboratory, in particular for damage caused by a non-compliance with users' obligations (including safety regulations) or with the directives of the TEM laboratory staff, as well as for the damage that was clearly caused by an incorrect operation of the device. Users are responsible in accordance with the valid statutory provisions. In the case of the rule violations, the head of the Chair is authorised to exclude the user from further operation.

§6 Data management

Experimental data are stored on the data and evaluation servers of the TEM laboratory, where they are available to users together with the necessary software for data processing and evaluation. The access to these servers is launched by the head of the TEM laboratory. The use of own storage media directly on the microscope is prohibited for security reasons. Due to limited storage capacity on the data and analysis servers, a long-term storage of measurement data cannot be guaranteed. For a long-term data backup and accessibility in terms of the FAIR criteria, the users are responsible.

§7 Publications

The handling of the experimental data stemming from the investigations carried out in the TEM laboratory of the IWW TU BAF has to follow the recommendations of the DFG for the publication of scientific data (see Codex: 'Safeguarding Good Scientific Practice' of September 2019, DFG).

In publications, the utilization of the microscope should be recognised by an acknowledgement to the DFG, e.g., 'The upgrade of the TEM JEM-2200FS was funded by the German Research Foundation under the project number 552804360'. Unless otherwise agreed, the Chair of Structure and Microstructure of Materials may use the results of the TEM investigations for teaching purposes, citing the source and/or mentioning the operator of the device.

§8 Contact persons

Head of the Chair of Structure and Microstructure of Materials at IWW TU BAF,
Prof. Dr. rer. nat. habil. David Rafaja, Tel.: 03731/39 2299,
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Head of TEM laboratory: Dr.-Ing. Mykhaylo Motylenko, Tel: 03731/39 3121,
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§9 Costs

For users from academia, the costs for using the TEM JEM-2200FS are based on the DFG guidelines (information on equipment usage costs and equipment centres, flat-rate usage fees for special equipment groups, http://www.dfg.de/formulare/55_04/55_04_de.pdf) and amount to 120 €/h in application mode and 200 €/h in service mode. Commercial prices for the TEM analyses and the costs for the sample preparation are available on request at the head of the Chair and/or at the

head of the TEM laboratory. No utilisation costs are incurred for the TEM investigations within a joint research project.