Facilities

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An overview is provided of the facilities available for X-ray absorption fine-structure measurements worldwide.

1. Introduction
The purpose of this chapter is to provide an overview of the facilities available for X-ray absorption fine-structure (XAFS) measurements worldwide. There are many variants of XAFS instruments, ranging from the relatively standard general-purpose hard X-ray beamlines for measurements in transmission, fluorescence and (possibly) electron-yield modes to more specialized beamlines. Examples of the latter include the following.

(i) Surface-science instruments, which often offer X-ray absorption near-edge structure (XANES) measurements for the determination of the orientation of adsorbed molecules or ultrathin films on a substrate, often in a grazing-incidence geometry.

(ii) Nano-analysis beamlines and dedicated experimental stations, which provide fluorescence mapping and spatially resolved XAFS for the study of highly heterogeneous materials, devices, biostructures, cultural heritage artefacts and samples relevant for environmental studies.

(iii) Experimental stations specifically designed for in situ and operando measurements in the field of (photo)electrochemistry, catalysis and batteries, possibly in combination with X-ray diffraction (XRD).

(iv) Beamlines exploiting circular polarization, which is of great importance for the study of magnetic materials.

(v) Specialized setups for pump-and-probe measurements allowing time-resolved XAFS measurements on a range of timescales, which are important in materials science, photochemistry and photobiology.

(vi) Experimental stations which allow a high-resolution spectroscopic analysis of photons scattered by a sample, which therefore allow resonant inelastic X-ray scattering (RIXS) and high energy resolution fluorescence-detected (HERFD) measurements, which are of interest in catalysis, environmental science and investigations of highly correlated materials, among others.

(vii) Specialized setups for the study of high energy density matter, i.e. conditions of high pressure, temperature, magnetic or electric fields (to study striction effects), often including high-power lasers for sample conditioning.

(viii) Instruments combining XAFS with variants of XRD, possibly including diffraction anomalous fine-structure (DAFS) measurements.
2. Europe and Middle East

2.1. Synchrotron-radiation sources

(i) ALBA, Barcelona, Spain: https://www.cells.es/en.
(ii) ASTRID2, Center for Storage Ring Facilities (ISA), Aarhus University, Aarhus, Denmark: https://www.isa.au.dk/facilities/astrid2/.
(iv) DAΦNE-Light, Laboratori Nazionali di Frascati, Istituto Nazionale di Fisica Nucleare (INFN), Frascati, Italy: https://dafne-light.lnf.infn.it/.
(v) Diamond Light Source, Harwell Science and Innovation Campus, Didcot, Oxfordshire, United Kingdom: https://www.diamond.ac.uk/Home.
(vi) ESRF – The European Synchrotron Radiation Facility, Grenoble, France: https://www.esrf.fr/.
(vii) Elettra Sincrotrone Trieste, Trieste, Italy: https://www.elettra.eu/.
(viii) KIT Light Source at Karlsruhe Institute of Technology, Karlsruhe, Germany: https://www.ibpt.kit.edu/KIT_Light_Source.php.
(x) MAX IV, Lund University, Lund, Sweden: https://www.maxiv.lu.se/.
(xi) PETRA III, Deutsches Elektronen Synchrotron (DESY), Hamburg, Germany: https://www.desy.de/services/petra3/.
(xii) SESAME, Allan, Jordan: https://www.sesame.org/jo/.
(xiii) Swiss Light Source (SLS), Paul Scherrer Institut (PSI), Villigen, Switzerland: https://www.psi.ch/en/sls.
(xiv) SOLARIS National Synchrotron Radiation Center, Krakow, Poland: https://solaris.tum.de/.
(xv) SOLEIL Synchrotron, Saint Aubin, France: https://www.synchrotronsoleil.fr/.

2.2. Free-electron laser sources

(ii) FERMI at Elettra, Trieste, Italy: https://www.elettra.eu/.
(iii) FLASH at Deutsches Elektronen Synchrotron (DESY), Hamburg, Germany: https://www.desy.de/services/flash.
(iv) SwissFEL, Paul Scherrer Institut (PSI), Villigen, Switzerland: https://www.psi.ch/en/swissfel.

3. Americas

3.1. Synchrotron-radiation sources

(i) Advanced Light Source (ALS), Berkeley, California, USA: https://als.lbl.gov/.
(iii) Center for Advanced Microstructures and Devices (CAMD), Louisiana State University, Baton Rouge, Louisiana, USA: https://www.lsu.edu/camd/index.php.
(iv) Canadian Light Source (CLS), Centre Canadien de Rayonnement Synchrotron, Saskatoon, Canada: https://www.lightsource.ca/index.php.
(vi) National Synchrotron Light Source II (NSLS II), Brookhaven National Laboratory, Upton, New York, USA: https://www.bnl.gov/nsls2/.
(vii) SIRIUS, Laboratorio Nacional de Luz Sincrotrón (LNLS), Campinas, São Paulo, Brazil: https://lnls.cnpem.br/home/.
(viii) Stanford Synchrotron Radiation Laboratory (SSRL), SLAC National Accelerator Laboratory, Menlo Park, California, USA: https://www-ssrl.slac.stanford.edu/.

3.2. Free-electron laser sources

Linear Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory, Menlo Park, California, USA: https://lcls.slac.stanford.edu/.

4. Asia and Australia

4.1. Synchrotron-radiation sources

(iii) Beijing Synchrotron Radiation Facility (BSRF), Beijing, People’s Republic of China: http://english.bsrfsr.hep.cas.cn/.
(iv) Hiroshima Synchrotron Radiation Center (HiSOR), Hiroshima University, Hiroshima, Japan: http://www.hsrcenter.hiroshima-u.ac.jp/english/index.html.

(vii) Photon Factory (PF) and Photon Factory Advanced Ring (PR-AR), High Energy Accelerator Research Organization (KEK), Tsukuba, Japan: https://www2.kek.jp/imss/pf/eng/.

(viii) Pohang Light Source II (PLS-II) at Pohang Accelerator Laboratory (PAL), Pohang, Republic of Korea: https://pal.postech.ac.kr/paleng/.

(ix) SAGA Light Source, Saga Prefecture, Japan: https://www.saga-ls.jp/main/207.html#gsc.tab=0.


(xi) Siam Photon Source, Synchrotron Light Research Institute, Nakhon Ratchasima, Thailand: https://www.slri.or.th/en/.

(xii) Singapore Synchrotron Light Source (SSLS), National University of Singapore (NUS), Singapore: https://ssls.nus.edu.sg/.


(xiv) Synchrotron Radiation Center, Ritsumeikan University, Shiga Prefecture, Japan: https://en.ritsumei.ac.jp/research/organizations/sr-center/.

(xv) Taiwan Light Source (TLS) and Taiwan Photon Source (TPS) at National Synchrotron Radiation Research Center (NSRRC), Hsinchu Science Park, Taiwan, Republic of China: https://www.nsrrc.org.tw/english/index.aspx.

(xvi) UVSOR-III, Institute for Molecular Science, Okazaki Prefecture, Japan: https://www.uvsor.ims.ac.jp/eng/.

(xvii) VEPP-3 and VEPP-4M, Siberian Synchrotron and Terahertz Radiation Center (SSTRC), Budker Institute of Nuclear Physics, Novosibirsk, Russian Federation: https://ssrc.biouml.org/.

4.2. Free-electron laser sources

(i) Pohang Accelerator Laboratory X-ray Free-Electron Laser (PAL-XFEL), Pohang, Republic of Korea: https://pal.postech.ac.kr/paleng/.