Infrared spectroscopic techniques measure the absorptivity and/or reflectivity of materials in the spectral range covering vibrational modes of covalent bonds, lattice resonances in crystals as well as phonons and plasmons in semiconductors and superconductors. This information yields insights into the identity, composition, structure and properties of materials that cannot be obtained by any other technique.

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ANKA – the Synchrotron Radiation Facility at KIT  
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Equipment for infrared spectroscopy and ellipsometry in the NIR, MIR, FIR and THz ranges

- Bruker IFS 66v/s FTIR spectrophotometer
- Vacuum infrared ellipsometer
- Detectors: 1.8 K and 4.2 K bolometers, MCT, DTGS-PE, DTLaGS, InSb, Si and Ge diodes
- Beamsplitters: Mylar 125 μm, 50 μm, 25 μm, Si/Mylar, KBr, quartz
- Liquid He cryostat
- Transmission, reflection and ATR accessories

ANKA-IR 1 Beamline

ANKA-IR 1 is one of the original complement of beamlines made available when the synchrotron first opened for users in 2003. It extracts classical synchrotron radiation and edge radiation from a bending magnet entrance in a 45 mrad x 15 mrad cone. A water-cooled Be mirror is used to separate wavelengths above 500 nm from the higher energies and reflect the former via a diamond UHV exit window to the experimental stations.

Infrared / THz Spectroscopy

The experimental station is based on an FTIR spectrophotometer (Bruker IFS 66v/S) covering a spectral range from 4 to 10,000 cm⁻¹ with a resolution down to 0.1 cm⁻¹. It is equipped with high sensitivity detectors (liquid He cooled bolometers, liquid N₂ cooled MCT and InSb detectors, and Si or Ge diodes) and appropriate beamsplitters (Mylar films, multilayer, KBr and quartz). The instrument is evacuated or N₂ purged to avoid water and CO₂ absorption bands. An extensive range of sample compartment accessories for measurements of liquid or solid samples in transmission, reflection or ATR geometries is available.
Infrared / THz Ellipsometry

Ellipsometry is a technique which allows one to measure the complex dielectric function \( \varepsilon = \varepsilon_1 + i\varepsilon_2 \) of a given material very accurately and with high reproducibility. It measures the change in polarization of light upon non-normal reflection on the surface of a sample to be studied. Unlike conventional reflection techniques, ellipsometry requires no reference measurement and no extrapolation of the reflectivity towards zero and infinite energy. This makes ellipsometry measurements more accurate and more reproducible than conventional reflection measurements. The ellipsometer at ANKA-IR 1 is operated by MPI-FKF Stuttgart and the University of Fribourg, Switzerland. It runs under vacuum and is equipped with an optimized bolometer detector and a liquid He cryostat.

Coherent THz Emission

The ANKA accelerator is regularly operated in low \( \alpha \) mode, where the electron bunch length is compressed to less than the wavelength of the emitted radiation in the THz range. The resulting coherent emission provides an extremely intense beam of light in the 5 – 50 cm\(^{-1}\) spectral range, which can be used at the ANKA-IR 1 beamline for THz spectroscopy and ellipsometry.