

Polymer analytics: Instrumental equipment

Optical spectroscopy

FTIR spectrometer Vertex 70 (Bruker)

- DTGS and MCT detector
- accessories for reflection methods: ATR (also temperature-dependent), DRIFT, IRRAS (also heatable)
- variable temperature cell (SPECAC) for temperature-dependent measurements from RT up to 700 °C
- connected FTIR microscope (HYPERION) with XY-cross table as well as programmable microscope hot stage and motorized knife edge aperture
- automatic search of spectra with different commercial-available and self-made data base libraries
- micro flow cell (AABSPEC mode #RA4000-EXP) for coupling of SEC/FTIR
- rheo-optical extension, rapid scan-mode

FTIR spectrometer Vertex 80v (Bruker)

- DTGS and MTC detector
- IRRAS (also heatable)
- external sample compartment: "Golden Gate Diamant ATR" (SPECAC) also temperature-dependent up to 200 °C
- integration module (Ulbricht sphere) for NIR with sample rotator for inhomogeneous samples

AFM-IR NanoIR 2 (Anasys/Bruker)

- OPO laser (3600-900 cm⁻¹)
- contact mode

FT-IR Imaging system Spotlight 400 (PerkinElmer)

- microscope detector: MCT line detector (imaging) and MCT single detector
- spectrometer detector: LiTaO₃ MIR detector
- operating modes: single spectra/ spectral imaging in transmission and reflection, micro-ATR
- particle recognition software

RAMAN microscope alpha 300R+ (WITec)

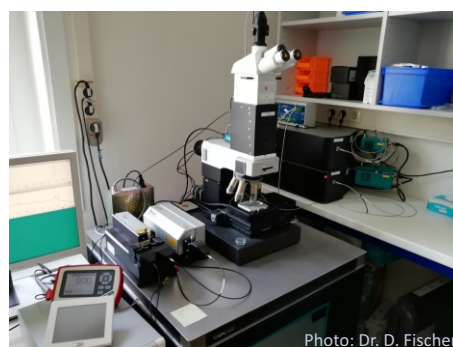
- 532 nm and 785 nm laser, UHTS 300 spectrometer, EMCCD detector, heatable microscope stage,
- External fiber-coupled probe for in-situ measurements
- operating modes: single spectra, times series, spectral 2D/3D imaging, depth profiling, True Surface (topographic profiling), bright field and dark field, resolution: 240 nm laterally
- external particle recognition software GEPARD

RAMAN microscope inVia Qontor (Renishaw)

- 532 nm, 633 nm and 785 nm laser, detector: CCD
- operating modes: single spectra, surface montage, spectral 2D/3D imaging, Live Track™, Focus Track™, bright field and dark field, resolution: 240 nm laterally
- Internal and external particle recognition software

Particle software GEPARD

- for optical, FTIR- and Raman microscopes (Open Source software)



Raman spectroscopy:
Raman microscope Qontor, RENISHAW (above)
Raman microscope alpha300R WITec (below)



SEC system with quadruple detection



Thermal field flow fractionation (Postnova) with
LS detection

Chromatography, fractionation und light scattering

Asymmetrical flow-field flow fractionation (AF4)

- Eclipse 3 (Wyatt Technologies Corp., USA), organic/aqueous, with isocratic pump, autosampler, UV and RI detector, and DAWN EOS MALS detector (18 angles, Wyatt Technologies Corp., USA)
- Eclipse Dualtec (Wyatt Technologies Corp., USA), aqueous, with isocratic pump, autosampler, UV and T-rEX-RI-detector, and HELEOS II MALS detector (18 angles, with QELS-module), Thermos Pro temperature control unit (Wyatt Technologies Corp., USA)

Thermal field flow fractionation (ThFFF)

- Complete system TF2000 (Postnova) with RI and MALS detector (Postnova Analytics GmbH, DE)

Size exclusion chromatography (SEC)

- different organic solvents (ambient and high temperature) and aqueous eluent (RT)
- Isocratic pumps, DA-, viscosity and RI detectors as well as autosamplers of 1100 and 1200 series (Agilent Technologies)
- Optilab T-rEX RI detector, TREOS and HELEOS II MALS detectors, QELS modules, Viscostar III (Wyatt Technologies Corp. USA)

Gas chromatography (GC)

- pyrolysis GC MS: pyroprobe (CDS Analytical Inc.) and GC7890A as well as MSD 5975C (Agilent Technologies)
- Headspace-GC-MS: Headspace sampler 7694, GC6890N and MSD 5973N (Agilent Technologies)

Batch characterization

- dynamic light scattering: DynaPro Nanostar (90°) from Wyatt Technologies Corp.
- Zeta potential measurements and dynamic light scattering: Zetasizer Nano Z (0-90 °C) with MPT-2 autotitrator (Malvern, UK)
- Microviscometer; Lovis (20-90 °C) (Anton Paar GmbH, Austria)

MALDI-TOF-MS

Autoflex Speed TOF/TOF System (Bruker)

- LC/MALDI-TOF-MS spray deposition interface ESAirD (BAM, Germany)

Elemental analysis

Elemental analyzer vario MICRO cube (Elementar)

- Determination of H, C, N and S content

NMR spectroscopy

NMR spectrometer Avance III 500 (Bruker)

- 3 HF channels (X; $^1\text{H}/^{19}\text{F}$; Y)
- z gradient accessories, temperature control unit and autosampler
- QNP probe (^1H ; ^{13}C ; ^{19}F ; ^{31}P) with z gradient
- TBI probe (^1H ; ^{13}C ; ^{31}P - ^{109}Ag) with z gradient
- BBO probe (^1H ; ^{19}F ; ^{31}P - ^{109}Ag) with z gradient
- 10 mm triple resonance probe (^1H ; X; ^{31}P)
- 4 mm HRMAS probe (^1H ; ^{13}C) with z gradient

Optical characterization of thin films

Rotating compensator multi wavelength ellipsometer alpha-SE (J.A. Woollam Co. Inc.)

- spectral range 380-900 nm, incidence angle 65°, 70° and 75°, with temperature and/or pH controlled in-situ fluid cell

Rotating compensator multi wavelength ellipsometer M2000 UI (J.A. Woollam Co. Inc.)

- spectral range 245-1700 nm
- incidence angle 45°-90°

Digital Multiple Wavelength Refractometer DSR Lambda (Schmidt + Haensch GmbH & Co.)

Müller matrix microscope (ACOM, University Nebraska-Lincoln)

- two rotating compensators,
- spectral range 250-1000 nm,
- single wavelength measurement modus, combinable with optically transparent microfluidic cells

Quartz crystal microbalance (Qsense, Biolin Scientific, Sweden)

- combinable with spectroscopic ellipsometry (alpha-SE, M2000 UI) or electrochemistry module

Thermal analysis

Thermobalance Q 5000 (TA Instruments)

- 40 up to 1000 °C, with autosampler, nitrogen or air, optionally coupled to FTIR spectrometer Nicolet 380 (Thermo Electron) and to GC-MS (Agilent) via IST16 interface (SRA Instruments)

Dynamic differential calorimeter DSC Q 1000 (TA Instruments)

- -80 up to 400 °C, with autosampler, nitrogen, optionally temperature-modulated

Dynamic differential calorimeter Discovery DSC 2500 (TA Instruments)

- -120 up to 400 °C, with autosampler, nitrogen and air, optionally temperature-modulated, with RCS120 cooling system

Contact

Leibniz-Institut für Polymerforschung Dresden e. V.
Macromolecular Structure Analysis

Dr. Alben Lederer

E-Mail: lederer@ipfdd.de

P +49 (0)351 4658 491

F +49 (0)351 4658 565

Hohe Straße 6 . 01069 Dresden . Germany

www.ipfdd.de