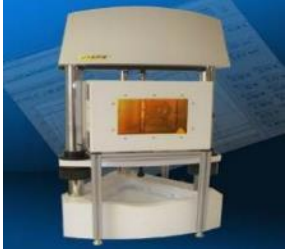
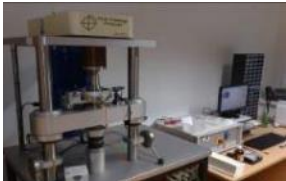
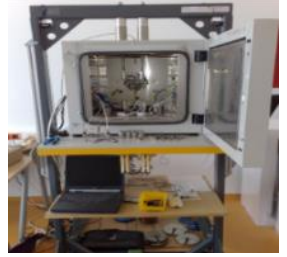


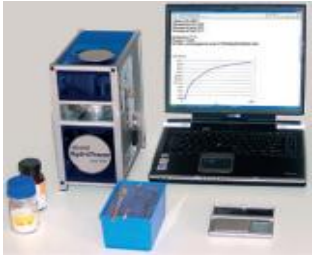
Mechanical Testing		
7 Universal testing machines incl. temperature chambers (Zwick GmbH & Co. KG., Instron Deutschland GmbH.) <u>Contact:</u> J. Grosser juergen.grosser@unileoben.ac.at Materials Science & Testing of Polymers	Tensile, compression and flexural testing, deformation measurement by various optical and contact extensometers. • Load range up to 250 kN • Displacement up to 1500 mm • Temperature range: -80 to 250°C	
Universal testing machines UTS 250 (Hegewald&Peschke GmbH) <u>Contact:</u> O. Rausch-Schott oliver.rausch-schott@unileoben.ac.at Processing of Composites	Compaction and tensile testing. Characterization of transversal fabric compaction characteristics. • Load range up to 250 kN • Compression of samples (fabric stacks) between movable plate and fixed stamp • Online acquisition of compressive load (load cell) and stack height (external LVDT) • Temp. range from 25°C to 140°C • Test configurations: • Loading/unloading experiments • Relaxation experiments • Fluid injection under load and temperature	 
8 Servo-hydraulic testing machines incl. temperature chambers (MTS Systems GmbH.) <u>Contact:</u> J. Föttinger juergen.foettinger@unileoben.ac.at Materials Science & Testing of Polymers	High-speed, high frequency and fatigue life analysis of polymers. • Impact-testing up to 6 m/s • Force up to 250 kN • Frequencies up to 300 Hz • Temperature range: -80 to 250°C	
Multiaxial component test field (MTS Systems GmbH.) <u>Contact:</u> J. Föttinger juergen.foettinger@unileoben.ac.at Materials Science & Testing of Polymers	Multiaxial high load component test field with 3 individual axes. • 15 kN, 250 kN and 1000 kN hydraulic actuators • Frequencies up to 100 Hz • Standard climate (23 °C/50 % rel.H.)	

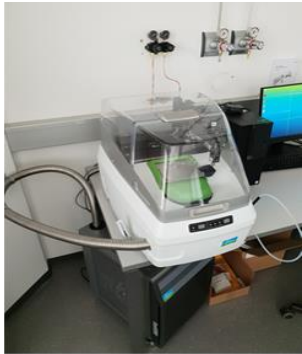
2 Electrodynamic testing machines, Bose 3450 and Bose AT3550 (Bose Corporation) <u>Contact:</u> F. Arbeiter florian.arbeiter@unileoben.ac.at Materials Science & Testing of Polymers	High frequency and fatigue life analysis of polymers. • Dynamic distance: +/- 12 mm • Force range up to 15 kN • Torque up to 36 Nm • Frequency up to 200 Hz • Temperature range: -80 to 250°C	
Electrodynamic testing machine, Instron E3000 (Instron Deutschland GmbH.) <u>Contact:</u> F. Arbeiter florian.arbeiter@unileoben.ac.at Materials Science & Testing of Polymers	High frequency and fatigue life analysis of polymers. • Dynamic distance: +/- 30 mm • Force range up to 3 kN • Torque up to 25 Nm • Frequency up to 100 Hz • Temperature range: -100 to 350°C	
Electrodynamic testing machine BOSE 3230 (Bose Corporation) <u>Contact:</u> M. Berer michael.berer@pccl.at Polymer Competence Center Leoben	Axial and torsional dynamic mechanical analysis of polymers. • Normal resolution: +/- 450 N (axial) • +/- 2.8 Nm (torsion) • +/- 6.5 mm (axial) • +/- 100 ° (torsion) • max. 200 Hz • Temperature range: -160 to + 300°C	
2 Dynamic mechanical analysers, DMA/SDTA861' & DMA/SDTA1+ (Mettler-Toledo GmbH) <u>Contact:</u> G. Pilz gerald.pilz@unileoben.ac.at Materials Science & Testing of Polymers	Thermo-mechanical material testing under tensile, bending, compression or shear loading. • Force range: 0.001 to 40 N • Frequency range: 0.001 to 1000 Hz • Temperature range: -150 to +500 °C	

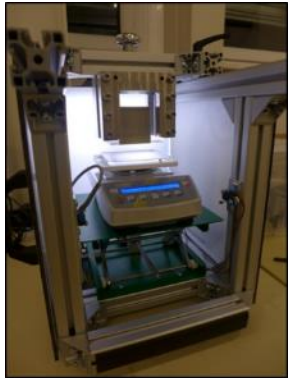
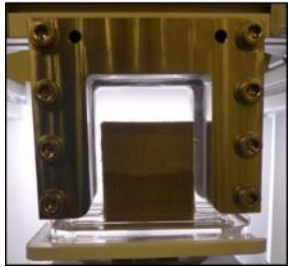
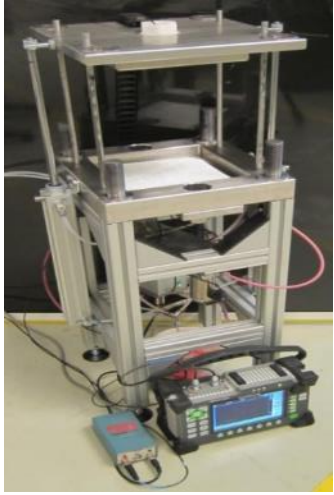
Dynamic mechanical analysers, MCR 702 MultiDrive (Anton Paar GmbH) <u>Contact:</u> G. Pilz gerald.pilz@unileoben.ac.at <i>Materials Science & Testing of Polymers</i>	Dynamic and static mechanical testing under tensile, bending, compression, shear or torsional loading over a wide temperature range. Measurements under controlled humidity and media immersion. • Force range: 0.0005 to 40 N • Torque range: 0.5 to 230 nNm • Max. displacement: ± 4.5 mm • Frequency range: 0.001 to 100 Hz • Temperature range: -160 to 350 °C • Humidity range: 5 to 95 % r.H.	
DMA 8000, PerkinElmer Dynamic mechanical analyser (PerkinElmer Inc.) <u>Contact:</u> J. Geier jutta.geier@pccl.at <i>Polymer Competence Center Leoben</i>	Thermo-mechanical material testing - single cantilever bending, dual cantilever bending, 3-point bending, tension, compression, shear, material pocket for testing of powder, mesh pockets, TMA mode, immersion studies (liquid environment). • Frequency 0,001 - 300Hz • Force $\pm 0,002$-10 N, resolution: 0,002 N • Temperature range: -190 to + 400°C • Displacement: 1-100µm, resolution: 1µm	
Thermo-mechanical analyser, TMA 841^e (Mettler-Toledo GmbH) <u>Contact:</u> G. Pilz gerald.pilz@unileoben.ac.at <i>Materials Science & Testing of Polymers</i>	Determination of the linear thermal expansion coefficient. • Max. specimens length: 20 mm • Measuring range: +/- 5 mm • Resolution: 10 nm • Temperature range: -150 to +600 °C	
Drop-weight-impact testing system (Instron Deutschland GmbH.) <u>Contact:</u> F. Arbeiter florian.arbeiter@unileoben.ac.at <i>Materials Science & Testing of Polymers</i>	Drop tower for high-speed and impact testing with anti-rebound mechanism. • Speed range: 0.77 to 24 m/s • Energy from 0.6 up to 1800 J • Temperature range: -70 to 150°C	

Impact testing pendulum Resil 25 (CEAST GmbH.) <u>Contact:</u> F. Arbeiter florian.arbeiter@unileoben.ac.at Materials Science & Testing of Polymers	For testing arrangements in izod, charpy and tensile impact. • Energy from 0.5 up to 50 J • Temperature range: -70 to 150°C	
Impact testing pendulum, HIT25/50P (Zwick GmbH. & Co KG) <u>Contact:</u> F. Arbeiter florian.arbeiter@unileoben.ac.at Materials Science & Testing of Polymers	For testing arrangements in izod, charpy and tensile impact. • 0.5, 2, 7.5, and 15 Joule impact pendulums	
Rotary tribometer, TE93 (PhoenixTribology Ltd.) <u>Contact:</u> T. Stiller (PCCL) tanja.stiller@pccl.at Polymer Competence Center Leoben	Friction and wear testing at component level. • Rotational movement • Force range from 1 up to 1000 N • Temperature range from 23 up to 200°C	
Universal Microtribometer UMT-2 (Bruker Corporation) <u>Contact:</u> M. Tockner (PCCL) martin.tockner@pccl.at Polymer Competence Center Leoben	Local surface characterisation of friction and wear, scratch and indentation. • Rotational, linear and cyclic movement • Force range from 0.1 up to 500 N • Temperature range from 23 up to 150°C	
Peel-Ply Test Rig (LVV construction) <u>Contact:</u> N. Yadav (LVV) neha.yadav@unileoben.ac.at Processing of Composites	Investigations on welded tapes to characterize interlaminar bonding between two tapes. • Spindle drive for linear movement • Hardened blade for splitting • Two load cells for characterizing bonding strengths	
Pipe internal pressure tester (self-made) <u>Contact:</u> F. Arbeiter florian.arbeiter@unileoben.ac.at Materials Science & Testing of Polymers	Accelerated long-term property test for plastic pipes. • Pressurizing liquid water • 150 test stands • Up to 30 bar • From RT up to 110 °C	

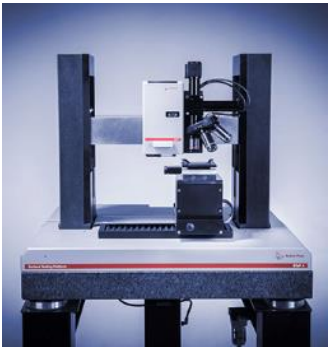
Strain Recovery Test Rig <i>Contact: T. Schrank (PCCL) theresia.schrank@pccl.at Polymer Competence Center Leoben</i>	The set-up is used to characterize the time-dependent response after the application of stress/strain to materials. Testing is carried out at room temperature.	
Testing device for CRB creep (Mechatronik Moharitsch) <i>Contact: I. Mitev ivaylo.mitev@pccl.at Polymer Competence Center Leoben</i>	Fracture mechanics creep tests of Cracked Round Bar (CRB) specimens to rank pipe grades by their resistance against slow crack growth. • RT up to + 150°C • Up to 2500N on each specimen • Clip gages for strain measurement	
Testing device for creep and relaxation (Mechatronik Moharitsch) <i>Contact: G. Meier gerald.meier@pccl.at Polymer Competence Center Leoben</i>	Characterize the viscoelastic properties of materials. It's possible to realize creep tests as well as relaxation tests in different adaptations • 5 specimens • Metal weights or pneumatic cylinders • Up to 10 kN • -20°C up to + 250°C	

Physical Testing		
Heat Deflection Temperature testing device (CEAST GmbH) <u>Contact:</u> M. Feuchter michael.feuchter@unileoben.ac.at Materials Science & Testing of Polymers	Determination of deflection under temperature according to ISO 75 and Vicat softening temperature according to ISO 306.	
Moisture-Meter FMX HydroTracer (aboniGmbH für Mess- und Automatisierungstechnik) <u>Contact:</u> I. Duretek (KV) ivica.duretek@unileoben.ac.at Polymer Processing	Instrument for measuring of low water contents in solids. • Sample weight: 0.01 g to 50 g (100 g) depending on density and moisture • Sample volume: approx. 50 cm³ • Measuring range: 0.0005 % - 5 % moisture content	
2 Differential Scanning Calorimeters, DSC 1 (Mettler-Toledo GmbH) <u>Contact:</u> M. Schwaiger markus.schwaiger@unileoben.ac.at Materials Science & Testing of Polymers <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Determination of thermo-calorimetric properties of polymers (glass transition, melting/crystallization, oxidation, curing, etc.). • Automatic sampler • Pre-programmable methods for 34 samples • 50°C to +700°C • Heating rate up to 60 K/min	
Fast Scanning Calorimeter, Flash DSC 2+ (Mettler-Toledo GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Determination of thermo-calorimetric properties of polymers (glass transition, melting/crystallization etc.) at ultra-high cooling and heating rates. • cooling rate: 6 K – 2'400'000 K/min • heating rate: 6 K – 3'000'000 K/min • temperature range: -95 °C up to 1'000 °C • Sensors: UFH 1 (high temp.) UFS 1 (Standard) • Measuring under oxygen-free conditions	

Differential Scanning Calorimeters, DSC 8000 (PerkinElmer Inc.) <u>Contact:</u> M. Schwaiger markus.schwaiger@unileoben.ac.at Materials Science & Testing of Polymers	Determination of thermo-calorimetric properties of polymers (glass transition, melting/crystallization, oxidation, curing, etc.). • Automatic sampler • Pre-programmable methods for 96 samples • -80°C to +750°C • Heating rate up to 300 K/min	
Fluorescence-Spectrophotometer (Varian Inc./Agilent) <u>Contact:</u> C.Barretta chiara.barretta@pccl.at Polymer Competence Center Leoben	Fluorescence analysis of liquid samples and films. • Xenon flash lamp • Reduced volume cuvettes • (40 and 400 µL) can be measured • Schwarzschild collection optics • Red-sensitive photomultiplier tube	
UV/VIS/NIR Spektrophotometer, Lambda 950 (Perkin Elmer Inc.) <u>Contact:</u> E. Helfer eric.helfer@pccl.at Polymer Competence Center Leoben	Measurement of optical properties and constants in the UV/VIS and NIR-region. • Wave length range 175 to 3300 nm • 150 mm integrating sphere • Measurement of hemispherical and diffuse transmittance and reflectance spectra •	
FTIR Spektrophotometer Frontier (Perkin Elmer Inc.) <u>Contact:</u> C. Barretta chiara.barretta@pccl.at Polymer Competence Center Leoben	Material characterization and identification, analysis of ageing, analysis of additives or stabilizing systems of polymers. Optical characterization of samples in the NIR, MIR and FIR-region (integrating sphere). • Wave length range: 1,4-27µm • heating plate up to a maximum of 210°C and ensuring the optimal sample orientation via a microscope, as well as taking pictures of the orientated samples (770 x 590 µm, max. 110x magnification) • The Pike Veemax II unite can create spectra in depth profiles from 0.5 to 10 µm using adjustable mirrors and various crystals (ZnSe and Ge). • EGA 4000-unit, analysis of gaseous substances that evolve from a sample during a thermo-gravimetric measurement.	

FTIR-Spectrometer Spectrum Two (Perkin Elmer, Inc.) <u>Contact:</u> J. Geier jutta.geier@pccl.at Polymer Competence Center Leoben	Material characterization and identification, analysis of ageing, analysis of additives or stabilizing systems of polymers. • Heatable ATR-device for curing studies • Wave length range: 10000 - 370cm⁻¹ • GladiATR: Attenuated Total Reflectance, Zn/Se-crystal • Wave length range: 4000 – 450cm⁻¹ • Controlled heating (RT-200°C)	
Capillarity Test Rig (LVV construction) <u>Contact:</u> St. Neunkirchen stefan.neunkirchen@unileoben.ac.at Processing of Composites	Capillary rise testing of textile fabrics. Characterization of fiber wetting mechanisms by using different test fluids • Data acquisition of fluid weight and temperature • Image acquisition and flow front detection • Specimen size: 60 mm x 65 mm • Adjustable cavity height: 0.5 to 12 mm	 
Out-of-Plane Permeameter (CD-Lab construction) <u>Contact:</u> E. Fauster ewald.fauster@unileoben.ac.at Processing of Composites	Ultrasonic-based characterization system for unsaturated out-of-plane permeability. • Flow front advancement (US sensor) • Fluid injection pressure (pressure sensor) • Fluid mass, fluid volume and fluid density (volume flow meter) • Cavity size: 200 x 200 mm • Variable cavity height (spacers) • Fully automated control and data evaluation with a customized LabView® application	

Contact Angle Measurement, DSA 100-HT400 (Krüss GmbH.) <u>Contact:</u> A. Wallner anja.wallner@unileoben.ac.at Polymer Processing	Determination of the surface polarity and the surface energy of materials at elevated temperatures (50°C to 200°C/400°C). Different test fluids can be applied. • Standard test liquids are ethylene carbonate and 1-Bromo-naphthalene (40°C to 200°C) • Applicable for solid materials • Additional dosing unit for polymer drops (up to 400°C). • Heated chamber (50°C to 400°C) • Pendant drop & sessile drop	
K-System II Thermal Conductivity Measurement Device (AC Technology) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Measurement of the thermal conductivity based on a line-source probe method. • Application: melt and solid-state thermal conductivity • Thermal conductivity range: 0.1 to 4 W/m.K • Temperature range: RT up to +350 °C	
TCi Thermal Conductivity Analyser (C-Therm) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Measurement of the thermal conductivity based on a modified transient plane source (MTPS) technique. • Thermal conductivity range: 0.03 to 10 W/m.K • Temperature range: -50 up to +200 °C •	
Hot Disk TPS 2500 S Thermal Constants Analyzer (Hot Disk AB) <u>Contact:</u> I. Mitev ivaylo.mitev@pccl.at Polymer Competence Center Leoben	Designed for analysing thermal transport properties of solids, liquids, paste and powders. • Thermal conductivity, diffusivity and specific heat measurement; cryogenic to 750°C; Measures solids (isotropic, transverse isotropic), liquids, powders, films	

Guarded heat flow meter DTC 300 (TA Instruments) <u>Contact:</u> I. Mitev ivaylo.Mitev@pccl.at Polymer Competence Center Leoben	Designed for analysing the thermal conductivity of solids, paste and powders. • Determination of the thermal conductivity in the range of 0.1 – 40 W/mK • Thermal conductivity over a temperature range of -20 to 300 °C • Sample thickness up to 25 mm, sample diameter 50 mm	
Heat Flux DSC 4000 (Perkin Elmer Instruments LLC) <u>Contact:</u> J. Geier Jutta.geier@pccl.at Polymer Competence Center Leoben	Dynamic heat flux calorimeter for determining thermal properties of polymers. • Temperature from -70 to 445 °C, heating rates 0.1 to 50°C/min, cooling rates up to -20°C/min Temperature accuracy: +/- 0.1°C • Heat flux range: +/- 175 mW Heat flux accuracy: +/- 2% • Dual, digital mass flow controller (gas controller) • Auto sampler for 42 samples • Optionally nitrogen or synthetic air atmosphere, automatic switchover of gas supply during the measurement	
UNHT³ Nanoindentation-System (Anton Paar TriTec SA.) <u>Contact:</u> P. Christöfl petra.christöfl@pccl.at Polymer Competence Center Leoben	Instrumented Indentation Testers measure a wide range of mechanical properties. A lot of different properties in a temperature range from ambient to 200°C can be obtained: • Hardness and Elastic Modulus • Indentation Creep and Indentation Relaxation • Creep compliance • Elastic and plastic energies • Viscoelastic properties • Fracture toughness • Stress-strain curves • Strain hardening • Fatigue testing • Nano-DMA (Sinus mode)	

NETZSCH LFA 467 HyperFlash (NETZSCH Gerätebau GmbH) <u>Contact:</u> I. Mitev ivaylo.mitev@pccl.at Polymer Competence Center Leoben	This device is measuring the thermal diffusivity and thermal conductivity • Temperature range: -100°C – 500°C • Thermal diffusivity: 0.01 mm²/s ... 2000 mm²/s • Thermal conductivity: 0.1 W/(mK) ... 4000 W/(mK) • Specimen dimensions: Diameter: 6mm - 25mm	
Viscosimeter DV-III Ultra with TC-602 (Brookfield) <u>Contact:</u> W. Kern wolfgang.kern@unileoben.ac.at Chemistry of Polymeric Materials	Determination of the viscosity of fluids. • 0,1001- 250 min⁻¹ (viscosity range) • From 15°C to 65°C (temperature range)	
Rheometer, MCR102 (Modular Compact Rheometer - Anton Paar) <u>Contact:</u> Th. Griesser thomas.griesser@unileoben.ac.at Chemistry of Polymeric Materials	Determination of the viscosity of fluids. • Shear rate: 0,1–13.5001/s¹ • Temperature range: 15°C to 40°C	

Microscopy, optical and acoustic methods

Optical microscope Zeiss Axioskop

(Carl Zeiss GmbH)

Contact: W. Rath
walter.rath@unileoben.ac.at
Materials Science & Testing of
Polymers

Optical characterization of surfaces and thin film observation

- Lenses: 25x, 50x, 100x, 200x, 500x
- Polarizer and DIC available
- ZenCore Software (Zeiss)



2x Microscope, Type BX 51 & SZX 12

(Olympus GmbH)

Contact: W. Rath
walter.rath@unileoben.ac.at
Materials Science & Testing of
Polymers

Optical characterization of surfaces and thin film observation

BX51:

Lenses: 50x, 100x, 200x, 400x, 500x

Polarizer available

SZX 12:

10X eyepieces

Magnification range from 7x to 90x



Light Microscope MAT 5/7

(Carl Zeiss GmbH)

Contact: M. Tockner
martin.tockner@pccl.at
Polymer Competence Center Leoben

Optical characterization of surfaces and thin film observation

- Magnifications: 25x-1000x
- Object stage: 200 x 170mm, adjustable in x(76mm), y (50mm), z(30mm) direction
- Motorized focus stroke 24mm (step size 78nm)
- Light/Darkfield
- Automatic lens recognition scaling



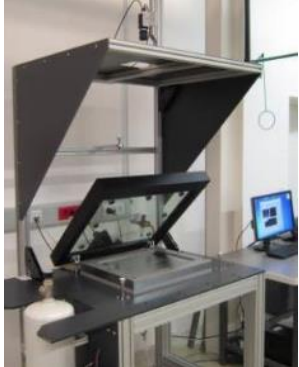
2 Stereomicroscopes Stemi 2000C (Carl Zeiss GmbH)

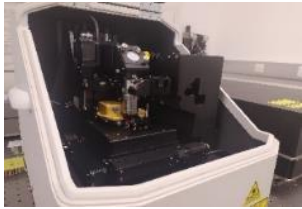
Contact: S.Hinterdorfer
stefan.hinterdorfer@pccl.at
Polymer Competence Center Leoben

Specifications for stereomicroscope.

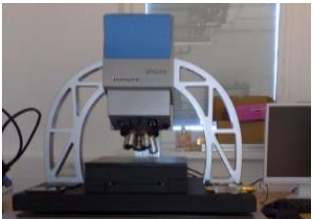
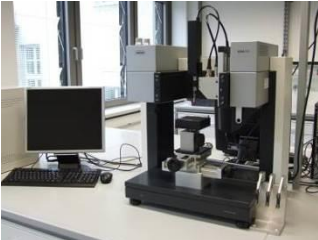
- 10X eyepieces
- 6.5X to 50X magnification range
- Field of view from 35.4mm-4.6mm



Digital microscope, Keyence VHX-7000 (Keyence GmbH) <u>Contact:</u> M. Huszar michael.huszar@unileoben.ac.at Materials Science & Testing of Polymers	Optical characterization of surfaces and thin film observation <u>Head:</u> • Lenses for 20x-6000x • Polarization filters and DIC available <u>Camera:</u> • Magnification: 0-50x	
Leica DCM8 Dual Core Microscope (Leica Microsystems GmbH) <u>Contact:</u> T. Ules thomas.ules@pccl.at Polymer Competence Center Leoben	Leica DCM8 is an optical 3-dimensional measuring-system combining interferometry, confocal microscopy and variation of focus. • Vertical resolution: 0,1nm • Lateral resolution: 140nm	
Optical Permeameter (LVV construction) <u>Contact:</u> E. Fauster ewald.fauster@unileoben.ac.at Processing of Composites	Determination of in-plane permeability of fibre textiles. • Possible fibre volume content: <60% • Viscosity: ca. 60mPas • Max. Injection pressure: 10bar • Measurement of main and auxiliary axis permeability by using optical image processing	
Scanning Electron Microscopes incl. EDX analysis (Tescan Orsay Holding) <u>Contact:</u> L. Haiden lukas.haiden@unileoben.ac.at Materials Science & Testing of Polymers	Determination of surface topography and composition with high resolution and high depth of sharpness. • Low voltage cathode optimized for testing of polymeric materials • Tungsten heated cathode intended for high vacuum operations • Back scattered electron detector (BSE) to analyse material contrast • Energy dispersive x-ray detector (EDX) for chemical/structural x-ray analysis • Additional 3D-module for topographical information	

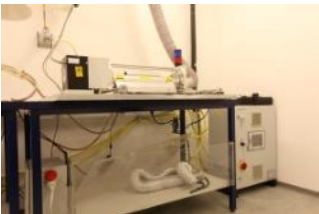
Atomic Force Microscope (Asylum Research) <u>Contact:</u> K. Resch-Fauster katharina.reschfauster@unileoben.ac.at Materials Science & Testing of Polymers	Atomic force microscopy is a very high-resolution type of scanning probe microscopy. • Contact mode, lateral force mode, • non-contact AC mode, intermittent-contact mode (Q Control, phase amplitude), dual AC mode, force mode, force modulation, force spectroscopy • Polymer heater for temperature dependent measurements up to 250°C	
Nanoscale Infrared Spectrometer (Anfatec Instruments AG) <u>Contact:</u> M. Feuchter michael.feuchter@unileoben.ac.at Materials Science & Testing of Polymers	Nano-IR is a combination of high-resolution scanning probe microscopy and photo-induced forces microscopy (IR spectroscopic) measurement. <u>AFM:</u> • Tapping mode, contact mode EFM, phase imaging KPFM <u>Spectroscopy:</u> • possible wavenumber ranges from 764cm⁻¹ to 1943cm⁻¹	
Raman Microscope incl. opt. table (HORIBA Jobin Yvon GmbH) <u>Contact:</u> M. Feuchter michael.feuchter@unileoben.ac.at Materials Science & Testing of Polymers	Contactless spectroscopic characterization of polymers via Raman-scattering, chemical and morphological analysis of polymers. • Lenses: 10x, 50x, 100x and LWD 100x • Lateral resolution: 0.8 to 5 µm • Vertical resolution: 2 µm • Spectral resolution: 0,5 cm⁻¹ • Green laser (514 nm) and red laser (632 nm)	
Nanostar (Bruker AXS GmbH.) <u>Contact:</u> M. Feuchter michael.feuchter@unileoben.ac.at Materials Science & Testing of Polymers	Characterization of nanostructures by SAXS, WAXS, GISAXS, Nanography. • IµS Microfocus Source • VÅNTEC-2000-detector and Image Plate • Temperature controlled measurements • Measurements under mechanical loads	

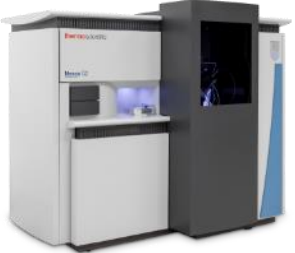
2x Mercury 2D/3D DIC System (Sobriety s.r.o.) <u>Contact:</u> J. Grosser juergen.grosser@unileoben.ac.at Materials Science & Testing of Polymers	Three-dimensional full field deformation and strain analysis based on digital image correlation. - Up to 29 Megapixel camera resolution - Up to 500 fps - Near and far range lenses	
ARAMIS 4M – 3D-Digital Image Correlation (GOM GmbH.) <u>Contact:</u> G. Meier gerald.meier@pccl.at Polymer Competence Center Leoben	Three-dimensional full field deformation and strain analysis based on digital image correlation. Maximum frame rate of 500 fps (1280x1024).	
High speed camera Photron SA1 (Photron Europe Limited) <u>Contact:</u> J. Petro julia.petro@pccl.at Polymer Competence Center Leoben	High-end and high-speed camera for impact material characterization and process analysis. Maximum frame rate 675000 fps	
High speed camera Photron Nova S6 (Photron Europe Limited) <u>Contact:</u> J. Grosser juergen.grosser@unileoben.ac.at Materials Science & Testing of Polymers	High speed camera for impact material characterization and process analysis. Maximum frame rate 800000 fps	
Thermography system (InfraTec GmbH) <u>Contact:</u> St. Neunkirchen stefan.neunkirchen@unileoben.ac.at Processing of Composites	Thermography system for sensing and controlling of manufacturing processes. - Spectral range 0,8 to. 2,5 µm - Detector format (IR pixels) 320 x 256 - Temp. resolution 0.025 K @ 30 °C - Temp. measuring range -40 to 1200°C	
Acoustic Emission (Mistras Group) <u>Contact:</u> M. Gfrerrer maria.gfrerrer@unileoben.ac.at Materials Science & Testing of Polymers	The Acoustic Emission System is used to detect acoustic signals in test specimens or components. 4 channel acoustic emission scanning system - up to 4 acoustic sensors	

NIR Equipment (Avantes) <u>Contact:</u> M. Salzmann moritz.salzmann@unileoben.ac.at <i>Processing of Composites</i>	NIR provides chemical, physical and structural information. • Halogen Light Source (Avantes) • Reflection Probe with 5 m Optical Fibre <u>Spectral Engines NIR-Spectrometer:</u> • S 1.7: 1350 - 1750 nm • S 2.0: 1550 - 1950 nm • S 2.2: 1750 - 2150 nm	
Confocal Microscope (Fries Research & Technology GmbH) <u>Contact:</u> T. Stiller tanja.stiller@pccl.at <i>Polymer Competence Center Leoben</i>	Optical 3D – measurement for computer-based measuring of roughness and profiles. • Contactless and non-destructive measurement in microscale • Calculation of sample-area and volume	
Infinite Focus System (Alicona Imaging GmbH) <u>Contact:</u> T.Ules thomas.ules@pccl.at <i>Polymer Competence Center Leoben</i>	Optical 3D micro-coordinate system for measurement of shape and roughness. • Optical technology based on focus-variation yielding a vertical • Resolution of up to 10nm and a lateral resolution of 400 nm • Measuring of steep flanks up to 85° with highest precision	
Optical Inspection Testsite <u>Contact:</u> A. Hable angelika.hable@pccl.at <i>Polymer Competence Center Leoben</i>	System for mapping surfaces and analysing visually perceivable defects and gloss effects. • Modular design for different measurement problems	
Contact Angle Measurement, DSA 100 (Krüss GmbH.) <u>Contact:</u> W. Kern wolfgang.kern@unileoben.ac.at <i>Chemistry of Polymeric Materials</i>	Determination of the surface polarity and the surface energy of materials. • Different test fluids can be applied. • Standard test liquids are water and diiodomethane • Applicable for solid materials	

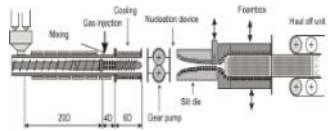
Mobile surface analyser Krüss GmbH <u>Contact:</u> Ch. Bandl christine.bandl@unileoben.ac.at Chemistry of Polymeric Materials	• Mobile surface analyzer,(MSA), • Determination of wetting behavior and analysis of surface free energy of solid and plane as well as curved samples	
ATR FT-IR microscopy, Lumos, Bruker <u>Contact:</u> N. Aust nicolai.aust@unileoben.ac.at Chemistry of Polymeric Materials	Qualitative and quantitative analysis of the major compounds/chemical structure of solid samples in combination with optical microscopy in a defined spot of the sample, mapping mode	
Mask Aligner, MJB 4 (SÜSS MicroTec AG) <u>Contact:</u> W. Kern wolfgang.kern@unileoben.ac.at Chemistry of Polymeric Materials	Optical lithography for pattern reproduction in photoresist films. • Lateral resolution 0,3 µm • Wavelength range 250 - 400 nm • Contact and non-contact lithography	
Microscope Optical microscopy, BX51 (Olympus GmbH.) <u>Contact:</u> W. Kern wolfgang.kern@unileoben.ac.at Chemistry of Polymeric Materials	Optical characterization of surfaces and thin film observation • Optical characterization at 10x – 100 x • magnification of solid and liquid samples	

Chemical methods		
UV-lamp (Omnigene S1500 spot curing system) <u>Contact:</u> S. Feldbacher sonja.feldbacher@pccl.at Polymer Competence Center Leoben	200 W mercury high pressure spot curing system. • 200 W mercury high pressure lamp • Adjustable light output in 1% increments • Timer • Broad emission spectra	
Dionex Ultimate 3000 Series (Thermo Fisher Scientific) <u>Contact:</u> C. Bracher christine.bracher@pccl.at Polymer Competence Center Leoben	High performance liquid chromatography (HPLC) is an analytical separation method in which the stationary phase is solid and the mobile phase is liquid. The difference to normal liquid chromatography is the high separation efficiency, which is achieved by very small, pressure-stable packing particles, low-pulsation pumps, high pressures, appropriate injection systems and miniaturized detectors. • Column Temperature Range 5°C to 80°C • Max. Pressure 62 Mpa (620 bar, 9000 psi) • Detector Data Collection Rate max. 100 Hz	
GCMS-QP2010 Ultra with EGA/PY-3030D Multi Shot Pyrolyser (Shimadzu Handelsgesellschaft GmbH) <u>Contact:</u> C. Barretta chiara.barretta@pccl.at Polymer Competence Center Leoben	Pyrolysis–gas chromatography–mass spectrometry (Py-GCMS) is a method of chemical analysis in which the sample is heated to decomposition to produce smaller molecules that are separated by gas chromatography and detected using mass spectrometry.	
LC-MS – System "LCQ Advantage Max" (Thermo Finnigan) <u>Contact:</u> C. Bracher christine.bracher@pccl.at Polymer Competence Center Leoben	High performance liquid chromatography coupled to mass spectrometry. • Ion trap with m/z from 150 up to 2000 at a scan rate of at least 5500 amu/s • Sensitivity for small molecules in the lower nmol/L range • ESI and APCI positive and negative ion mode	

TGA 8000 (Perkin Elmer, Inc.) <u>Contact:</u> C. Barretta chiara.barretta@pccl.at Polymer Competence Center Leoben	Highly sensitive thermogravimetric analysis system for quantitative investigation of product compositions and thermal stability • Heating rates from 0,01 to 500 K/min • Temperature range: up to 1200 °C • Sample weight up to 1300 mg • Sensitivity 0,1 µg • Accuracy of scale: >0,02 % of total weight of sample and pan • Gas control: mass flow controller (nitrogen and synthetic air)	
Corona-Station (Ahlbrandt System GmbH.) <u>Contact:</u> S. Amirosanloo siavash.amirosanloo@pccl.at Polymer Competence Center Leoben	Surface activation of foils and polymer materials. • Sample thickness up to 10 mm • Generator power 100 – 600 W • Surface oxidation via corona discharges	
Glove-Box Lab master 130 (M. Braun GmbH.) <u>Contact:</u> M. Koinigg michael.koinigg@unileoben.ac.at Chemistry of Polymeric Materials	The glove-box is employed for air or moisture sensitive laboratory work (synthesis, polymerization, etc.). • Working gas (N₂): 200 bar (primarily) • 5,5-6,0 bar (secondarily) • Gas flow rate: 200 l/min • Water cooling (10°C - 15°C) • High vacuum pump	
Falling film photo reactor (UV Consulting Peschl) <u>Contact:</u> S. Schlögl sandra.schloegl@pccl.at Polymer Competence Center Leoben	Continuous UV irradiation of liquids and emulsions on technical scale. • Lamp power 800 – 3500 W • Pumping rate 0.2 – 2.5 l/min	

UV-lamp (Fusion UV Systems GmbH.) <u>Contact:</u> S. Schlögl sandra.schloegl@pccl.at Polymer Competence Center Leoben	Microwave powered UV-lamp with dichroic reflector and constant UV-emission. • Bulb length 250 mm • Power 240 W/cm • Variable power 25-100% UV • Bulbs Hg / Fe and Ga doped Hg	
Thermogravimetric Analysis TGA/DSC 3+ STARE System (Mettler Toledo GmbH.) <u>Contact:</u> M. Sharifian mohammadhossein.sharifian@unileoben.ac.at Chemistry of Polymeric Materials	Determination of a temperature induced weight loss as well as the heat flow into the sample. • +25°C to +900°C (temperature range) • Various atmospheres (nitrogen, air, oxygen)	
Thermogravimetric Analysis TGA/DSC 1 (Mettler Toledo GmbH.) <u>Contact:</u> M. Sharifian mohammadhossein.sharifian@unileoben.ac.at Chemistry of Polymeric Materials	Determination of a temperature induced weight loss as well as the heat flow into the sample. • From +25°C up to +900°C (temperature range) • Various atmospheres (nitrogen, air, oxygen)	
X-ray photoelectron spectrometry (XPS), (Nexsa G2, ThermoFisher Scientific) <u>Contact:</u> T. Griesser Thomas.griesser@unileoben.ac.at Chemistry of Polymeric Materials	Qualitative and quantitative analysis of elemental surface composition of solid samples, determination of chemical species, mapping and depth profiling of elemental composition. Surface characterization, elemental analysis, chemical State Imaging and rapid survey spectrum acquisition. • Characterization methods: depth • Profiling, mapping, insulator analysis • Lateral resolution 10 µm • Energy resolution 0.5 eV • Source-defined analysis area 10 to 400 µm	
Photo-DSC, 204 F1 Phoenix (Erich NETZSCH GmbH & Co KG) <u>Contact:</u> Th. Griesser thomas.griesser@unileoben.ac.at Chemistry of Polymeric Materials	Characterization of photo-initiated reactions in a broad variety of materials. • Gas-tight measuring cell measuring the cross-link kinetics of polymer resins, paints, coatings and to analyze the influence of UV stabilizers • 100°C to 200°C (temperature range)	

NMR Spectrometer NMReady-60Pro Nanalysis GmbH <u>Contact:</u> W. Kern wolfgang.kern@unileoben.ac.at <i>Chemistry of Polymeric Materials</i>	^1H and ^{13}C NMR spectroscopy, NMReady-60Pro, Nanalysis Qualitative and quantitative analysis of the chemical structure of liquid or dissolved samples; 60 MHz, Benchtop NMR spectrometer. NMReady-60 spectrometer operates at field strengths of 1.4 Tesla. For ^1H, the resonance frequencies (Larmor frequencies) then correspond to 60 MHz.	
GCMS- ISQ™ 7000 Single Quadrupole GC-MS System (Thermo Fisher Scientific GmbH) <u>Contact:</u> G. Rieß gisbert.riess@unileoben.ac.at <i>Chemistry of Polymeric Materials</i>	Gas chromatography – mass spectrometer for material characterization and identification. • Capillary: fused silica • Purge gas: Helium Injection: auto sampling or manual injection	
Plasma Ion Etching, PlasmaLab 80Plus (Oxford Instruments) <u>Contact:</u> W. Kern Wolfgang.kern@unileoben.ac.at <i>Chemistry of Polymeric Materials</i>	Dry etching and surface functionalization of organic and inorganic materials with reactive gases. • 13.56 MHz parallel plate reactor • 240 mm substrate electrode • Etch modes: RIE, PE, ICP • Various process gases	
Infrared-Spectrometer (BRUKER VERTEX 70) <u>Contact:</u> N. Aust nicolai.aust@unileoben.ac.at <i>Chemistry of Polymeric Materials</i>	Material characterization and identification. • Wavelength 8000 - 350 cm^{-1} • MIR • Transmission, ATR, Reflexion	
UV/VIS Spectrophotometer Cary 50 Conc (Varian Inc.) <u>Contact:</u> N. Aust nicolai.aust@unileoben.ac.at <i>Chemistry of Polymeric Materials</i>	Measurement of UV/VIS/NIR-transmittance of liquid and solid samples. • Wavelength 200 - 1100 nm • Temperature controlled cuvette holder • Determination of absorption of polymers and compounds	

Polymer processing		
Multilayer flat film processing line (Dr. Collin GmbH.) <i>Contact: B. Haar</i> <i>bernd.haar@pccl.at</i> <i>Polymer Competence Center Leoben</i>	5-layer flat film line. • 2 extruders "Teachline E20T-H SCD15" • Extruder "Teachline" E30P, • Feed block 5 layer • Flat die width 250 mm • Chill roll 136-350 • Corona unit	
Rosendahl extrusion line (Rosendahl Maschinen GmbH, Colortronic Maschinen- und Anlagenbau AG, Maximator GmbH) <i>Contact: S. Schuschnigg</i> <i>stephan.schuschnigg@unileoben.ac.at</i> <i>Polymer Processing</i>	The single screw extrusion line can be used for film extrusion and foaming. • 2 Volumetric dosing units • Single screw extruder D=45 mm • different screws 24-30 D • Different dies (film, strand, ...)	
Rosendahl extruder fluor resistant (Rosendahl Maschinen GmbH) <i>Contact: S. Schuschnigg</i> <i>stephan.schuschnigg@unileoben.ac.at</i> <i>Polymer Processing</i>	The single screw extrusion line can be used for high temperature fluorinated polymers. • Single screw extruder D=30 mm • Screws 24D • High temperature till 500 °C	
Foam extrusion line (in-house development) <i>Contact: S. Schuschnigg</i> <i>stephan.schuschnigg@unileoben.ac.at</i> <i>Polymer Processing</i>	Extrusion line for investigating the physical foaming process. • Different solutions to cool the melt during the extrusion are available to produce foams with small cell sizes and a high number of cells • Suitable for different materials like PE, PP, PS, PET and TPE's • Suitable for inert gases like CO2, N2	
Extruder for measuring the friction coefficient (in-house development) <i>Contact: S. Schuschnigg</i> <i>stephan.schuschnigg@unileoben.ac.at</i> <i>Polymer Processing</i>	Extruder for measuring the friction coefficient. The extruder for measuring the friction coefficient is used to measure the outer and inner friction of polymer bulk material under circumstances nearly the same as in real extruders.	

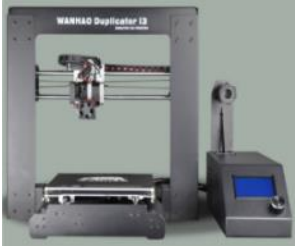
Filter pressure extruder (Dr. Collin GmbH) <u>Contact:</u> S.Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	Single screw Extruder. • Filter test extruder FT-E20T-MP-IS • Melt pump • Filter holder • It can detect agglomerates of pigments and other fillers	
Pipe extrusion line (Cincinnati Extrusion GmbH, KUAG, GRAEWE GmbH) <u>Contact:</u> S.Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	Pipe extrusion line. • Proton 45-28 G extruder loaned by Cincinnati Extrusion • Vacuum chilling bath ATL-C 63 loaned by Kuag • Puller RAE 63/1 loaned by Kuag • Cutter TE 63 H by Graewe	
Conical counter rotating twin screw extruder (Cincinnati Extrusion GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The conical counter rotating twin screw extruder Konos 38RP is used for the research in the rheology and processing of PVC-U, WPC and other extrudable polymer melts. • Screw diameter 38 mm • Max. output (PVC-U): 65-100 kg/h • Horizontal dosing feeder (synchronized) • Max. screw rot. speed: 47 rpm • Max. torque to the screws: 3,05 kNm	
Lab-Mixer Rheocord 300p (Rheomix 600p and 3000p) (Gebrüder HAAKE GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The Lab-Mixer is used for mixing and kneading of small polymer batches. • Temperature range: +25 to +400 °C • Rheomix 600p: mixing chamber net vol.: ~ 50 ccm • Rheomix 3000p: mixing chamber net vol.: ~ 300 ccm • Rotor types: roller, banbury	
Lab-Mixer Plasti-Corder Lab-Station EC (Mixer 50 EHT and 350E) (Brabender® GmbH & Co. KG) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The Lab-Mixer is used for mixing and kneading of small polymer batches. • Temperature range: +25 to +300 °C (500 °C) • Mixer 50 EHT: mixing chamber net vol.: ~ 35 ccm • Mixer 350E: mixing chamber net vol.: ~ 370 ccm • Rotor type: roller	

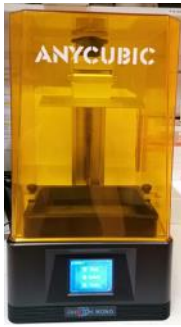
Lab Mixer Plasticorder PL 2000 (Brabender® GmbH & Co. KG) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The Lab-Mixer is used for mixing and kneading of small polymer batches. + 25 to 300 °C - Mixing chamber net vol.: ~ 30 ccm - Rotor types: roller, delta, banbury	
Compounder ZSE 18HP-48D (Leistritz Extrusionstechnik GmbH) <u>Contact:</u> S. Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	The ZSE 18 HP compounder from Leistritz is equipped with two dosing units one for polymers and one for metallic powders. - Maximum melttemperature 450°C - Wear resistant	
Roll mill Type W 150 P (Dr. Collin GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The roll mills are used for processing test formulations and incorporating of additives in materials. - Rolling diameter 150 mm - Working width 315 mm - Rotation speed 3 – 30 1/min - Gap 0.1 – 5 mm - Temperature 20 to 270 °C	
Electric injection moulding machine 470 A 1000-400 (ARBURG GmbH + Co KG) <u>Contact:</u> T. Lucyshyn thomas.lucyshyn@unileoben.ac.at Polymer Processing	Electric injection moulding machine, as a loan by Arburg, for research and education. Max. clamping force 1000 kN	
Hybrid injection moulding machine VC 940/130 (Engel Austria GmbH) <u>Contact:</u> E. Leitner eduard.leitner@unileoben.ac.at Polymer Processing	Hybrid machine with hydraulic, tie bar-less clamping unit and electrical injection unit, for the X-melt technology and for injection-moulding rheometry. - Max. clamping force 1300 kN - X-Melt option - Thermoplastics and rubbers - Ejection option	

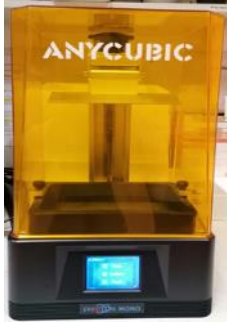
Two component injection moulding machine HM 110/350H 130V (2K) (Wittmann Battenfeld GmbH) <u>Contact:</u> T. Lucyshyn thomas.lucyshyn@unileoben.ac.at <i>Polymer Processing</i>	Two component injection moulding machines, for the research of the bonding between two different polymers. Additionally, Machine Vision system and variothermal mould temperature control. • Max. clamping force 1100 kN	
Injection moulding compounder E-Motion 740/180T (Engel Austria GmbH, Leistritz Extrusionstechnik GmbH, ECON GmbH) <u>Contact:</u> E. Leitner eduard.leitner@unileoben.ac.at <i>Polymer Processing</i>	Injection moulding compounder where the melt delivered by the compounder is transferred directly to the injection moulding machine. • Max. clamping force IMM 1800 kN • Screw diameter IMM: 35 and 45 mm • Extruder length 44D or 52D • 5 dosing units (incl. liquids) • Max. temperature 400 °C	
Injection moulding machine for powder injection moulding 320 C 500 -100 (ARBURG GmbH + Co KG) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at <i>Polymer Processing</i>	Injection moulding machine for metal and ceramic PIM-feedstocks. • Max. clamping force 500 kN • Screw diameter: 20 mm	
Injection moulding machine rheometer (self made construction within the framework of the EU-project Pro4Plast) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at <i>Polymer Processing</i>	Viscosity measurement system based on injection moulding machine rheometer. • Several slit dies (h= 0,35; 0,5; 1 mm) • Ambient up to 380 °C • Measuring the pressure dependence of viscosity • back pressure: up to 600 bar • shear rate range: approx. 10 s⁻¹ up to	

Vertical Rubber injection moulding machine MTF 750/160 Edition (Maplan, GmbH) <u>Contact:</u> B. Lechner Bernhard.lechner@pccl.at Polymer Competence Center Leoben	Vertical Rubber injection moulding machine as a loan by Maplan, for the research of new technologies in cure time reduction. • Max. clamping force 1600 kN • Max. injection volume 750 ccm	
PIM-Injection moulding machine rheometer (self made construction) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Viscosity measurement system based for rheological measurements on PIM-feedstocks using injection moulding machine. • Injection moulding machine: Arburg 320 C 500 -100 • Slit dies (h= 1; 1,5; 2; 2,5 mm) • Temperature range: RT up to 400 °C • Shear rate range: approx. 10 s⁻¹ up to 10.000 s⁻¹	
Injection-moulding machine rheometer for rubber compounds (self made construction) <u>Contact:</u> R. Kerschbaumer roman.kerschbaumer@pccl.at Polymer Competence Center Leoben <u>Contact:</u> E. Leitner eduard.leitner@unileoben.ac.at Polymer Processing	Viscosity measurement system for rubber compounds with and without curatives. • Several slit dies (h= 2; 2,5; 3 mm) • Temperatures of up to 150 °C • Measuring the pressure dependence of viscosity • Back pressure: up to 400 bar • Shear rate range: approx. 10 s⁻¹ up to 2.000.000 s⁻¹	
Blow forming machine KEB 1 (Kautex Maschinenbau, Alpla Inc.) <u>Contact:</u> M. Glehr Martin.glehr@unileoben.ac.at Polymer Processing	Single stage blow forming machine KEB 1. • T_{max}=300 °C • V_{max}=500 ml • Single stage blow forming machine KEB 1, produced by Kautex	
Shear sensor (in-house development) <u>Contact:</u> S. Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	Shear sensor used in extrusion and injection moulding. • T_{max}=320 °C • Measurement of shear stress of fluid inline	

Hydraulic press Polystat 300 (Schwabenthon) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Production of sample plates using different types of polymers. • Mould tempering: oil • Size of the finished plate: 190 x 190 mm, height: max 15 mm • Temperature range: +20 to +250 °C • Max. hydraulic pressure: 300 bar	
Vacuum press P200PV (Dr. Collin GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Production of sample plates under vacuum using different types of polymers. • Temperature range: +20 to +350 °C • plate size: 195 x 195 mm • max. press force: 196 kN	
Vacuum press P300SV (Dr. Collin GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Production of sample plates under vacuum using different types of polymers • Temperature range: +20 to +450 °C • plate size: 296 x 296 mm • compression moulding tool: 200 x 200 x 20 mm • max. press force: 300 kN	
Laboratory platen press COLLIN P 300 E+ (Dr. Collin GmbH) <u>Contact:</u> H. Fladenhofer Herbert.fladenhofer@pccl.at Polymer Competence Center Leoben	Production of films or sheets from different types of polymers. • Working space 296 mm x 296 mm • Maximum surface temperature 300 °C • Maximum working pressure 6 bar	
Granulate Dryer Wittmann Drymax (Wittmann Kunststoffgeräte GmbH) <u>Contact:</u> B. Haar Bernd.haar@pccl.at Polymer Competence Center Leoben	The granulate dryer is capable to provide dry granulate on a semi-industrial scale for subsequent processing. • Mass: 150 kg • Filling volume: 2 x 30 L, 2 x 15 L • Temperature range: 60 – 120 °C	
Thermoforming machine, UA 60 EDH OST G (Illig Maschinenbau & Co KG) <u>Contact:</u> M. Glehr Martin.glehr@unileoben.ac.at Polymer Processing	Thermoforming machine. • Single stage thermoforming machine • Tmax=300 °C	

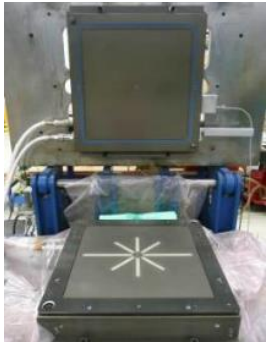
2 x MEX Printer Hage3DpA2 (HAGE) <u>Contact:</u> S. Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	The MEX Printer from Hage is an additive manufacturing machine using polymers in filament. • Print size (W x L x H) 620 mm x 400 mm x 290 mm • Max. Temperature Hotend 240°C, Bed 110°C	
MEX Printer Hage 140 L (HAGE) <u>Contact:</u> S. Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	The MEX Printer from Hage is an additive manufacturing machine using polymers in filament. • Print size (W x L x H) 700 mm x 500 mm x 400 mm • Max. Temperature Hotend 300°C, Bed 110°C	
MEX Printer (Wanhao USA) <u>Contact:</u> S. Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	The MEX Printer from Wanhao is an additive manufacturing machine using polymers in filament. • Print size (W x L x H) 200 mm x 200 mm x 180 mm • Max. Temperature Hotend 240°C, Bed 100°C	
MEX Printer Prusa i3 MK3S+ (Prusa) <u>Contact:</u> S. Schuschnigg stephan.schuschnigg@unileoben.ac.at Polymer Processing	The MEX Printer from Hage is an additive manufacturing machine using polymers in filament. • Print size (W x L x H) 250 mm x 210 mm x 210 mm • Max. Temperature Hotend 300°C, Bed 120°C	
CreatBot F430 3D-printer (Henan Suwei Electronic Technology Co., LTD.) <u>Contact:</u> I. Raguz Ivan.raguz@pccl.at Polymer Competence Center Leoben	3D printing refers to processes used to synthesize a three-dimensional object in which successive layers of material are formed under computer control to create an object. • Dimensions(B/H/T): 660x470x560 mm • Printing Volume (X/Y/Z): 400x300x300mm	

Additive Manufacturing and Photopolymerization <i>Contact: Th. Griesser Thomas.griesser@unileoben.ac.at Chemistry of Polymeric Materials</i>	Different LCD based 3D printer for the processing of photosensitive resins. • Photon Ultra • Photon Mono • Photon Zero • Anycubic	
Additive Manufacturing and Photopolymerization Anycubic 3D Printer – Photon Zero (Shenzhen ANYCUBIC Technology Co., Ltd.) <i>Contact: Th. Griesser Thomas.griesser@unileoben.ac.at Chemistry of Polymeric Materials</i>	Stereolithography 3D printing is used to create three-dimensional objects from liquid photopolymers, by selective curing via ultraviolet light.	
Printer DMP-2800 (Fujifilm Dimatix Inc.) <i>Contact: Th. Griesser Thomas.griesser@unileoben.ac.at Chemistry of Polymeric Materials</i>	Printer for testing ink jet inks with dropwatcher. • Dimensions up to A4 • Temperature range 20 - 60 °C	
Additive Manufacturing and Photopolymerization Anycubic 3D Printer – Photon Mono X (Shenzhen ANYCUBIC Technology Co., Ltd.) <i>Contact: Th. Griesser Thomas.griesser@unileoben.ac.at Chemistry of Polymeric Materials</i>	Stereolithography 3D printing is used to create three-dimensional objects from liquid photopolymers, by selective curing via ultraviolet light.	
Qidi X-Max 3D-printer (ZheJiang Qidi Technology Co., Ltd.) <i>Contact: B. Haar bernd.haar@pccl.at Polymer Competence Center Leoben</i>	3D printing refers to processes used to synthesize a three-dimensional object in which successive layers of material are formed under computer control to create an object. • Dimensions(B/H/T): 600x550x600 mm • Printing Volume (X/Y/Z): 300x250x300mm	

Anycubic 3D Printer – Photon Mono X (Shenzhen ANYCUBIC Technology Co., Ltd..) <u>Contact:</u> K. Hrbinic katja.hrbinic@pccl.at Polymer Competence Center Leoben	Stereolithography 3D printing is used to create three-dimensional objects from liquid photopolymers, by selective curing via ultraviolet light.	
Anycubic 3D Printer – Photon Zero (Shenzhen ANYCUBIC Technology Co., Ltd..) <u>Contact:</u> K. Hrbinic katja.hrbinic@pccl.at Polymer Competence Center Leoben	Stereolithography 3D printing is used to create three-dimensional objects from liquid photopolymers, by selective curing via ultraviolet light.	
Modular Compact Rheometer MCR501 (Anton Paar GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Measurement of the flow properties and dynamic-mechanical analysis of polymers. • Operating mode: rotational and oscillatory, CSS, CSR Dynamical mechanical analysis • Measuring the transient extensional viscosity using SER-tool • Temperature range: RT up to +600 °C • Various types of cone and plate tools (D=10, 25 and 50 mm is available) • Torque range: 0.01 to 300 mNm • Frequency range: 10⁻⁵ to 500 rad/s	 
Tensile tester Rheotens 71.97 (Göttfert Werkstoff-Prüfmaschinen GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Measurement of elongational properties of polymer melts. • Tandem pulley system • Variable acceleration • Elongational velocity up to 1900 mm/s • Software for calculation of elongational viscosity	

High Pressure Capillary rheometer Rheograph 2002 (Göttfert Werkstoff-Prüfmaschinen GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The high-pressure capillary rheometer is used for the rheological measurement of polymer melts and other fluids. • Single barrel system • Operating mode: rate and stress-controlled • Measurement of the pressure dependence of viscosity • max. force: 20 kN • max. piston velocity: 20 mm/s • Temperature range: RT up to +400 °C • Shear rate range: ~ 10 up to 1.000.000 s⁻¹ • Capillary geometries: round, slit, micro-slit	
High Pressure Capillary rheometer Rheograph RG50 (Göttfert Werkstoff-Prüfmaschinen GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The high-pressure capillary rheometer is used for the rheological measurement of polymer melts and other fluids. • Dual barrel system • Operating mode: rate and stress-controlled • max. piston force: 50 kN • max. piston velocity: 40 mm/s • Temperature range: RT up to +500 °C • Shear rate range: ~ 10 up to 50.000 s⁻¹ • Capillary geometries: round, slit	
Modular Compact Rheometer MCR702 TD (Anton Paar GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Determination of deformation and flow properties of various polymer melts. • Twin drive • Electrical heating up to +400 °C • Convection heating up to +600 °C • Various measurements tools: cone / plate • Operating mode: rotational and oscillatory, CSS, CSR	

PVT100 (SWO Polymertechnik GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	The pvT 100 from SWO is used for measuring the specific volume as function of pressure and temperature (pvt-diagram). • Temperaturerange: RT up to +400 °C • Isobaric / isothermal (cooling / heating) measuring mode • Pressure range: 200 bar – 2400 bar • Cooling rates: up to 0,1 K/s	
D-RPA 3000 (MonTech Werkstoffprüfmaschinen GmbH) <u>Contact:</u> B. Lechner bernhard.lechner@pccl.at Polymer Competence Center Leoben	The Rubber Process Analyser (RPA) is a measurement device for rubber, cured and un-cured rubber compounds, silicones, thermoplastic elastomers and other polymers. • Curemetry, • Dynamic viscosity • Characterisation of viscoelastic properties.	
Hydraulic press LZT-OK-80-SO (Langzauner GmbH) <u>Contact:</u> M. Bender marcel.bender@unileoben.ac.at Processing of Composites	The press is used for mould carrying, FRPC processing through RTM and capacitive permeability measurement. • Working space 1500 x 850 mm • Maximum working pressure 800 kN • Max. stroke 1000 mm • Flexible usage of clamping cylinders	
Hydraulic press WKP 3500 S (Wickert Maschinenbau GmbH) <u>Contact:</u> St. Oswald stefan.oswald@unileoben.ac.at Processing of Composites	The press is used for compression moulding, impact extrusion and high pressure - RTM. • Working space 800 x 800 mm • Maximum working pressure 3.500 kN • Vacuum chamber integrated • Maximum surface temperature 400 °C • Auxiliary equipment: IR-preheating station; Robot-guided material handling	

Pultrusion Line (LVV construction) <u>Contact:</u> O. Rausch-Schott oliver.rausch-schott@unileoben.ac.at <i>Processing of Composites</i>	For continuous fabrication of FRPC-profiles with constant cross-section. Modular, flexible and expandable concept • Two-shell die / die holder system for pultrusion dies with various cross sections • Open resin bath or injection box • Heating elements forming heat zones • Individual heat zone control • Caterpillar pulling unit, integrated cutting unit; Max. pulling force: 24kN; Pulling speed: 0,01- 10m/min	
Injection unit (Tartler GmbH) <u>Contact:</u> M. Bender marcel.bender@unileoben.ac.at <i>Processing of Composites</i>	Flow metering and self-regulating two component metering and mixing machine. • Dimension (B x H x T): 1000 x 2100 x 1400 mm • Tank: 10 l each component • Electrical tank heating: max. 80°C	
IR-heating system (LVV construction) <u>Contact:</u> E. Fauster ewald.fauster@unileoben.ac.at <i>Processing of Composites</i>	Double-sided heating system by ceramic radiation emitters. • Heating area: 800x800 mm • Modular construction • Individual regulation of the heating module • Max. heating temperature + 400°C	
Capacitive Permeameter (Präzisionsmaschinenbau Bobertag GmbH) <u>Contact:</u> M. Bender marcel.bender@unileoben.ac.at <i>Processing of Composites</i>	Determination of in-plane permeability of fibre textiles. • 8x capacitive sensors • Possible fibre volume content: <63% • Viscosity: ca. 60mPas • Max. Injection pressure: 10bar Measurement of permeability using the capacitive sensors	

Vacuum infusion <i>Contact: M. Salzmann moritz.salzmann@unileoben.ac.at Processing of Composites</i>	Vacuum infusion technique for especially prototype manufacturing. • Vacuum pump: up to -1 bar • Geometries: depends on the tie geometry, used flow agents, reinforcing fibres and the used matrix system • With or without flow agents • Possible combination with the electrical heated convection oven	
Winding Technologies (LVV construction) <i>Contact: St. Neunkirchen stefan.neunkirchen@unileoben.ac.at Processing of Composites</i>	Robotic winding system. Dry fiber winding. Friction and slippage determination and measurement. • KUKA robot KR 150 R 2700 extra • KUKA axis Posiflex KPF1-H250-OR-H900 • Winding and Ring winding head • Sauter FK 250 with Tensiometer • Mandrel for friction measurements • Characteristics: ◦ Mandrel rotation up to 132 °/s ◦ Robot speed up to 2 m/s • Max. payload: 150 kg robot/ 250 kg axis	
Roving Test Rig (LVV construction) <i>Contact: E. Fauster ewald.fauster@unileoben.ac.at Processing of Composites</i>	Test rig for investigation of single fibre bundles as well as fibre-reinforced polymer tapes. • Transportation of single fibre bundles and tapes at specific processing conditions, e.g. speed, tensile force • Analysis of the impregnation behaviour of fibre bundles at static and dynamic conditions • Study of the cross-sectional geometry by means of a light-sectioning sensor ◦ Flexible extensibility of the test rig by additional sensors, e.g. camera system for visual observations	

Thermoplastic Tape Placement (LVV construction)

Contact: N. Yadav
neha.yadav@unileoben.ac.at
Processing of Composites

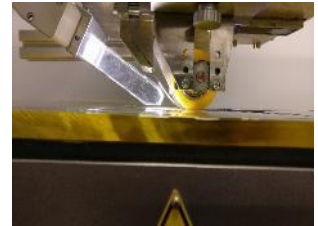
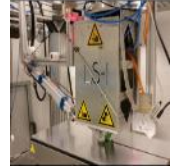
Investigations of different laying techniques and their process parameters.

Specifications test rig:

- Working area: 700 mm x 350 mm
- Electrical linear driven heating plate
- Tape laying head for tape appliance
- Heating system options:
 - Infrared heater
 - Flash light heating
 - Direct flame

Specifications robot:

- Tape laying head for tape appliance



Specimen preparation and conditioning

Climate chamber (Vötsch Industrietechnik GmbH.)

Contact: J. Föttinger
juergen.foettinger@unileoben.ac.at
Materials Science & Testing of
Polymers

Climate chamber for preparing test samples.

- Temperature from -40°C to +180°C
- Humidity Range 10% to 98%



Drying oven **SF 110** (Mettler GmbH)

Contact: J. Föttinger
juergen.foettinger@unileoben.ac.at
Materials Science & Testing of
Polymers

Temperature chamber for preparing test samples.

- Internal dimensions B x H x T:
560 x 480 x 400 mm
- Temperature up to +250 °C



Drying oven **FDL 115** (Binder GmbH)

Contact: S. Oswald
stefan.oswald@unileoben.ac.at
Processing of Composites

Preheating oven by symmetric air convection Construction after EN 1539.

- Internal dimensions B x H x T:
600 x 435 x 435 mm
- Max. oven temperature +300 °C
- Heating rate: RT auf +300 °C in
51 min



Curing oven ITHL 300°C (DBK David + Baader GmbH) <u>Contact:</u> O. Rausch-Schott oliver.rausch-schott@unileoben.ac.at <i>Processing of Composites</i>	Convection oven with two operation modes (Circulating air mode; Exhaust air mode) Temperature control based on: Circulating air temperature, or material temperature. • Inner dimensions 1900 x 1900 x 1900 mm • Max. oven temperature +300°C • Heating rate: 300°C in 120 min • Colling rate: 300°C to 60°C in 90 min • Two-level loading trolley	
Suntester CPS+ (Atlas Material Testing Technology LLC) <u>Contact:</u> C. Barretta Chiara.barretta@pccl.at <i>Polymer Competence Center Leoben</i>	Artificial weathering of samples by artificial sunlight. • 1x 1500W air-cooled xenon lamp • 560 cm² exposure area • Direct setting and control of irradiance • Controlled wavelength range 300 - 800 nm	
Xenontest - Atlas Beta LM (Atlas Material Testing Technology LLC) <u>Contact:</u> C. Barretta Chiara.barretta@pccl.at <i>Polymer Competence Center Leoben</i>	Artificial weathering of plastic samples. • Xenon arc lamps • Radiation intensity: 2.5 times global radiation • Rel. humidity: up to 100% • Spray option • RT to 90 °C	
UV-Test (Atlas Material Testing Technology LLC) <u>Contact:</u> C. Barretta Chiara.barretta@pccl.at <i>Polymer Competence Center Leoben</i>	Artificial weathering of samples by UV radiation. • UV fluorescence lamps • radiation intensity: 1,8 UV-A und 1,5 UV-B • Spray option • Temperature up to 80°C	

Climate Test Chamber (Mettmert GmbH Co.KG) <u>Contact:</u> S. Maar Sebastian.maar@pccl.at Polymer Competence Center Leoben	Climate chamber for conditioning and preparation of test samples. • From 42°C up to +190°C • Humidity Range 10% to 95%	
Temperature and Climatic Test System WKL 64-40 (Weiss Umwelttechnik GmbH) <u>Contact:</u> C. Barretta Chiara.barretta@pccl.at Polymer Competence Center Leoben	The equipment is designed for temperature and climatic tests. It is possible to conduct tests to determine the effects of temperature and humidity on the material properties and reliability of a test specimen. • Temperature range without humidity control: -40 °C to +180°C • Temperature range with humidity control: +10 °C to +98°C • Humidity range: 10 to 98 % RH	
Chlorine Dioxide Exposure Device (Mechatronik Moharitsch) <u>Contact:</u> I. Mitev Ivaylo.mitev@pccl.at Polymer Competence Center Leoben	Conditioning of test specimens in chlorinated water. • Chlorine dioxide (ClO₂): max. 10 ppm • Sodium hypochlorite (NaOCl): max. 100 ppm • Temperature: max. 60 °C • pH controlled • Tank volume: 50 l	
Vacuum Drying Chamber Binder VD 23 (Binder GmbH) <u>Contact:</u> B. Haar bernd.haar@pccl.at Polymer Competence Center Leoben	Polymers containing exceeding amount of moisture commonly lead to poor product performance and quality • Dimensions (W x H x D): 0,7 x 1,2 x 1,5 m³ • Chamber volume: ca. 23 L • Temperature range: 20 – 200 °C • Vacuum: up to 2 mbar absolute	

Vacuum Drying Chamber Binder VD 23 (Binder GmbH) <u>Contact:</u> I. Duretek ivica.duretek@unileoben.ac.at Polymer Processing	Polymers containing exceeding amount of moisture commonly lead to poor product performance and quality • Dimensions (W x H x D): 0,7 x 1,2 x 1,5 m³ • Chamber volume: ca. 23 L • Temperature range: 20 – 200 °C • Vacuum: up to 2 mbar absolute	
Drying cabinet Binder ED 53 (Binder GmbH) <u>Contact:</u> C. Bracher christine.bracher@pccl.at Polymer Competence Center Leoben	The equipment is suitable for drying/heating from preferred solid samples • Temperature range: 25 °C – 300 °C • Space inside: W/H/D 400/400/330mm • Volume of the chamber: 70l	
Drying cabinet Heratherm OMS 180 (Thermo Electron LED GmbH) <u>Contact:</u> C. Bracher christine.bracher@pccl.at Polymer Competence Center Leoben	The equipment is suitable for daily heat- and drying-applications up to 250°C. • Temperature range: 50°C to 250°C • Space inside: W/H/D: 464 x 708 x 543 mm • Volume of the stainless-steel chamber: 179 l	
Drying cabinet Memmert UF 55 (Mettler-Toledo GmbH & Co KG) <u>Contact:</u> C. Bracher christine.bracher@pccl.at Polymer Competence Center Leoben	Precise drying, heating, annealing, aging, baking and curing in research, science, industry and quality management. • Temperature range: 20°C to 300 °C • Inside space: W/H/D 400/400/330mm • Volume Indoor 53 l	

Drying cabinet Memmert SF 110 (Mettmert GmbH & Co KG) <u>Contact:</u> J. Föttinger juergen.foettinger@unileoben.ac.at Materials Science & Testing of Polymers	Precise drying, heating, annealing, aging, baking and curing in research, science, industry and quality management. • Temperature range: 20°C to 300 °C • Inside space: W/H/D 400/400/330mm • Volume Indoor 110 l	
Recirculating Air Drying Chamber & Sterilizer (Thermo Electron Corporation & Mettmert GmbH +Co. KG) <u>Contact:</u> H. Fladenhofer herbert.fladenhofer@pccl.at Polymer Competence Center Leoben	The ovens are used for precise drying, heating, annealing, baking, testing und curing of specimens in research and development • Temperature range: 20 °C to 320 °C • Ventilation: electrical controlled fresh air supply	
Flame treatment equipment Arcotec GmbH <u>Contact:</u> Ch. Bandl christine.bandl@unileoben.ac.at Chemistry of Polymeric Materials	Flame treatment equipment • Oxidative treatment of solid samples, surface pretreatment	
Surface Activation and Treatment Ahlbrandt System GmbH <u>Contact:</u> W. Kern wolfgang.kern@unileoben.ac.at Chemistry of Polymeric Materials	• Corona discharge instrument • Oxidative treatment of solid samples, surface modification and pretreatment	

Drying oven five different air circulation ovens (Binder GmbH and Heraeus (Thermo Fisher)) <u>Contact:</u> M. Koinigg michael.koinigg@unileoben.ac.at <i>Chemistry of Polymeric Materials</i>	Preheating oven by symmetric air convection Construction after EN 1539. • Max. oven temperature +300 °C • Heating rate: RT auf +300 °C in 50 min	
Metkon Forcipol 102 (Metkon Instruments Inc.) <u>Contact:</u> S. Hinterdorfer stefan.hinterdorfer@pccl.at <i>Polymer Competence Center Leoben</i>	The Metkon Forcipol 102 is a high-quality grinding device with an automated grinding head. • grinding pad: rotational speed 600 U/min; Ø250 mm • specimen holder: 6 spots, Ø30 mm • contact pressure: 6 bar, 60N • pivotable water supply → lubricant & coolant, with cleaning function • Pneumatic height adjustment of the grinding head • Manual and automated operation	
Digital Cutter G3 (Zünd Systemtechnik AG) <u>Contact:</u> M. Salzmann moritz.salzmann@unileoben.ac.at <i>Processing of Composites</i>	Digital controlled cutter for textiles and prepreg materials • Working area: 1600 mm x 1330 mm • Pneumatic oscillating cutting tool • Power rotary cutting tool • Vacuum material hold-down	
Grinding and polishing machines (BUEHLER USA) <u>Contact:</u> W. Rath walter.rath@unileoben.ac.at <i>Materials Science & Testing of Polymers</i>	Sample-preparation for light microscopy and micro analytical testing. • Sandpaper grit designations from P600 to P2400 and polishing fluids with particle sizes of 3 µm (diamond emulsion) • Specimen holder with applicable pressure, rotating and contra-rotating arrangement	

Microtome (Leica Microsystems GmbH) <u>Contact:</u> W. Rath walter.rath@unileoben.ac.at Materials Science & Testing of Polymers	For manual or automatic cutting, with disposable blades. Nitrogen-cooling for soft materials. - Thin sections from 0.5 to 600 µm - Automatic cutting velocities from 0.5 to 420 mm/s	
2 Vacuum drying oven (Heraeus GmbH.) <u>Contact:</u> W. Rath walter.rath@unileoben.ac.at Materials Science & Testing of Polymers	Vacuum oven for preparing test samples. - Approximately 25l volume - RT up to 200°C - Up to 0,01 mbar	
Climate chamber (Weiss Umwelttechnik GmbH.) <u>Contact:</u> J. Föttinger juergen.foettinger@unileoben.ac.at Materials Science & Testing of Polymers	The system is used for conditioning samples and components under specific temperature and humidity during various tests directly on material testing machines. - Temperature range from -65°C up to +180°C - Humidity range from 30% up to 95% r.H.	
Muffle furnace (Carbolite GmbH) <u>Contact:</u> M. Glehr (KV) martin.glehr@unileoben.ac.at Polymer Processing	Burn composite specimens to determine subsequently the fiber content. +20°C to +1000°C - Size 210x100x260mm (W x H x D)	

Vacuum Sealer Allpax (Henkelmann GmbH.) <u>Contact:</u> E. Leitner, M. Glehr eduard.leitner@unileoben.ac.at martin.Glehr@unileoben.ac.at <i>Polymer Processing</i>	The vacuum sealer is used for the tight packaging of specimens and components.	
Laboratory fridge Mediline LKPr 1420 (Liebherr) <u>Contact:</u> R. Kerschbaumer (PCCL) roman.kerschbaumer@pccl.at <i>Polymer Competence Center Leoben</i>	• 1427l storage area • Temperature range: 2-16 °C	
International Standard Tool - Injection mold <u>Contact:</u> E. Leitner eduard.leitner@unileoben.ac.at <i>Polymer Processing</i>	Injection-molding of IST injection mold standard test specimens for mechanical material investigation (e.g. tensile test, impact bending test) and sample parts (plates, step treads, surface samples). • Exchangeable mold inserts • Set of mold inserts for mold temperature up to 220°C	
Test Specimens <u>Contact:</u> E. Leitner eduard.leitner@unileoben.ac.at <i>Polymer Processing</i>	Injection-molding of standard test specimens for mechanical material investigation • International Standard ISO A Z-gate (170 x 10 x 4 mm) • International Standard ISO B double T-gate (80x10x4 mm) • International Standard ISO D2 double film gate (60 x 60 x2 mm)	

Simulation Tools	
Computer-Aided Design <u>Contact:</u> O. Rausch-Schott oliver.rausch-schott@unileoben.ac.at <i>Processing of Composites</i>	• CATIA V6R2012x (Dassault Systemes) • 3DEXPERIENCE 2022 • Solid Works 2012 (Educational Edition, Dassault Systemes)
Material Selection <u>Contact:</u> G. Pilz (WPK) gerald.pilz@unileoben.ac.at <i>Materials Science & Testing of Polymers</i>	• Cambridge Engineering Selector, EduPack (Granta Design)
Meshing and Flow Simulation Tools <u>Contact:</u> lvv@unileoben.ac.at <i>Processing of Composites</i>	• TexGen® • Visual Mesh® • PAM-RTM® • OpenFoam®
General Purpose Software <u>Contact:</u> lvv@unileoben.ac.at <i>Processing of Composites</i> <u>Contact:</u> P. Fuchs peter.fuchs@pccl.at <i>Polymer Competence Center Leoben</i>	• Abaqus (Dassault Systemes) • Ansys (Ansys Inc., US) • Digimat (e-Xstream engineering S.A., BE) • LS-DYNA (Livermore Software Technology Corp.) • MSC Nastran (MSC Software Corp.)