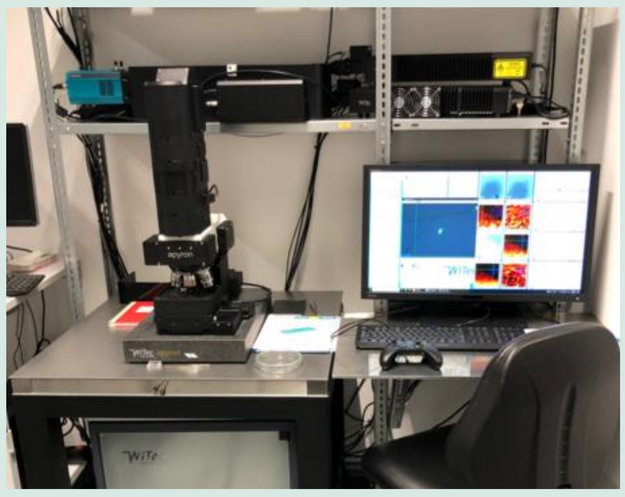
INSTITUTE OF WATER CHEMISTRY

Raman & SEM Group: Research Topics

Institute of Water Chemistry
Chair of Analytical Chemistry and Water Chemistry,
TUM School of Natural Sciences, Department of Chemistry
Technical University of Munich

Raman Microspectroscopy



Combination of Raman spectroscopy with confocal optical microscopy

- Non-contact & non-destructive
- Vibrational fingerprint spectra
- Spatial resolution in µm-range
- Chemical 2D & 3D imaging
- No interference of water

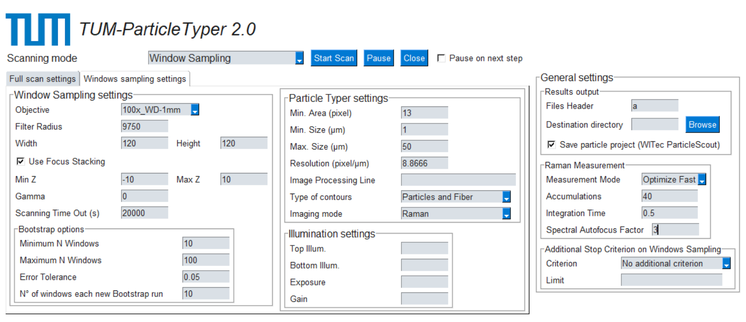
Scanning Electron Microscopy

Field emission SEM with variable pressure and cryo options

- Spatial resolution in nm-range
- Elemental composition based on characteristic X-rays (EDX)
- Analysis of non-conducting, water-containing and sensitive samples

Automated Quantification of Microplastic Particles

- *TUM-ParticleTyper 2* + Raman Microspectroscopy : Automated detection, identification and quantification of particles (1 µm– 1mm)
- Characterisation of environmental samples
- 2D & 3D imaging in biota samples



HOTMIC

JPI OCEANS

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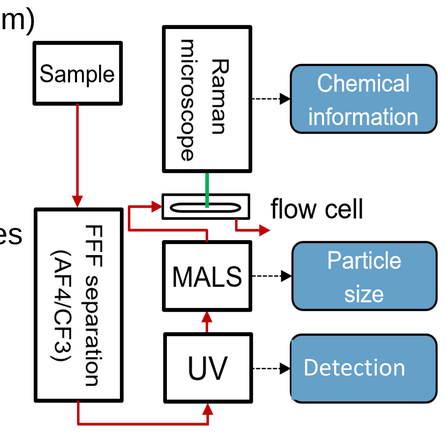
Analysis of Nanoplastic Particles

- Online coupling of field flow fractionation (FFF) and Raman microspectroscopy for separation and chemical identification of particles (<5 µm)
- Asymmetrical flow (AF4) & centrifugal FFF (CF3)
- Optical trapping of particles in a flow cell enables acquisition of Raman spectra
- Optimization for real (environmental) samples
- Quantification of nanoplastics using Nanoparticle Tracking Analysis (NTA)



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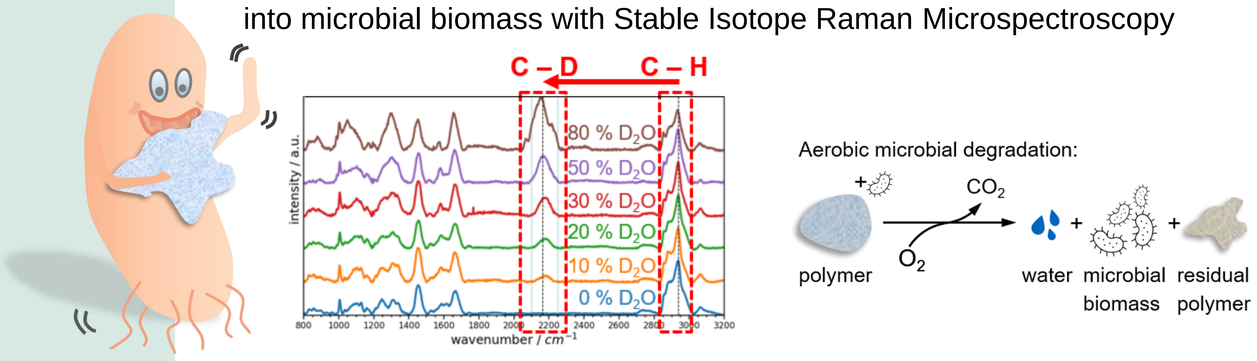
Biodegradation of Microplastic Particles

- Method development to monitor conversion of microplastics into final degradation products (CO_2, H_2O and microbial biomass)
- Trace heavier stable isotopes from labelled polymer into microbial biomass with Stable Isotope Raman Microspectroscopy



Mean Raman spectra of 50 *S. koreensis* cells incubated with different ratios of D_2O as reference spectra for deuterated cells.

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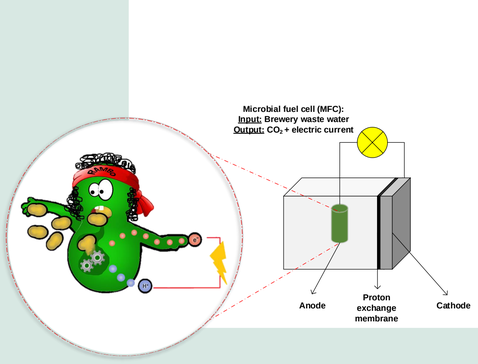
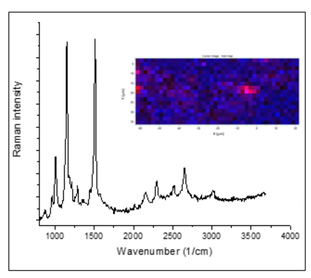
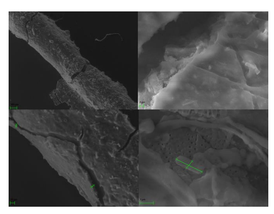
Biofilms in Microbial Fuel Cells

- *In situ* characterization of biofilms from microbial fuel cells (MFC)
- Finding possible electron shuttle mechanisms in MFC biofilms for electricity generation ⇒ “system of carotenoids”
- Characterization of the biofilm’s integrity
- Visualization of the biofilm’s structure on the µm-scale via SEM







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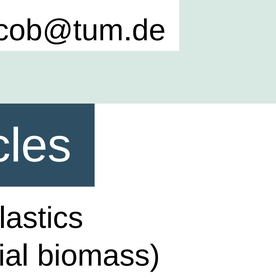
Particle Characterization in Industry

- Development of laser-induced-breakdown spectroscopy (LIBS) methods for the application in industry e.g.:
  - Element quantification in alloy particles to identify the source material
  - Chemical Mapping of component materials



Microstructures of a Cu- (left), Fe- (center) and Al- (right) alloy to visualize present phases and inhomogeneities.

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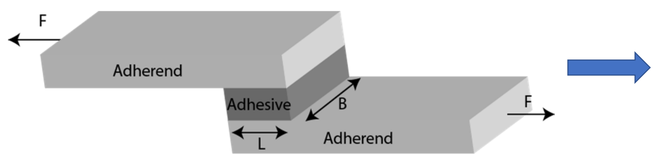
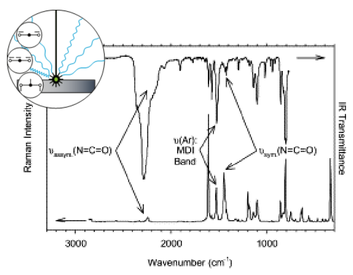
Nondestructive analysis of adhesives

Replacement of destructive lap-shear test due to high cost and low sustainability

- Tracking of polymerisation process via Raman and IR spectroscopy under varying environmental conditions
- Combination of spectroscopic data with destructive analysis to develop prediction models for the strength of adhesives





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https://www.ch.tum.de/hydrochemistry/raman-sem

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