

DSM Resolve

Service Information Sheet

no. 13-001

Analytical Competences

Characterization of Macromolecules

For macromolecules (polymers), material properties such as reactivity, chemical resistance, adhesion, network and processing properties originate from their complex, molecular architecture. Resolve has unique knowledge of assessing all kinds of architectural features and linking these features to macromolecular properties of polyolefins, elastomers and rubbers. This allows you for example to understand your synthetic process, its process technological aspects and the final properties of your resulting product.

Morphological Characterization of Materials

Next to molecular architecture, a material's morphology i.e. its physical 'shape' at a nanometer to millimeter scale dominates material properties and behavior. Resolve has broad expertise in the whole chain starting from architecture, via morphology toward the final, resulting materials properties. This unique knowledge position can be of great help for you in addressing mechanical failure and understanding processing properties.

Product Analysis

Resolve has extensive high level skills in the application of a whole range of (chemical and physical) techniques to analyze and characterize final products, in particular polymer products. This is of major importance in understanding final product properties such as surface/ adhesive/degradation phenomena, optical properties, mechanical behavior etc.

Chemical Identification and Quantification

Chemical identification and quantification of active components is of utmost importance in the development of new materials, processes and screening methods, either of synthetic *or* natural origin. Due to the in-house availability and knowledge of almost all currently known high-end, state-of-the-art analysis technologies, the Resolve specialists can be a strong partner for you.

Process Analytics

For securing good processing and production of your materials, process safety and in-line process and product control are crucial. Resolve has extensive knowledge of measuring in the field of chemical processes (lab-scale and full-scale production), radioactive measurements and assessing process safety with respect to runaways, thermal effect and explosions.

Education

Resolve can be your partner in training and education by providing professional courses in Mathematics & Statistics (Basic Statistics and Design of Experiments), Morphology (Basic course in morphology of polymers) and Process Safety (ExELect demo, explosions and runaway reactions). Additionally, our experts can be hired for practical, hands-on training courses at the Chemelot site. Furthermore, Resolve contributes to 'Youth and Chemistry' and 'JetNet' initiatives.

Analytical Capabilities

Chromatography, Mass Spectrometry, Macromolecular Characterization

- GC with wide variety of injection technologies (PTV, on-column, split/splitless, cold trap, dynamic and static headspace and pyrolysis) and detection techniques (FID, ECD, NPD, TCD) and coupling to MS.
- Comprehensive GCxGC coupled to FID and MS.
- HPLC (all known separation types including chiral chromatography) coupled to a variety of detection techniques (UV/VIS, RI, ELSD, fluorescence, electrochemical, conductivity).
- LC-MS: LC-TOF-MS, LC-QIT-MS, LC-³Q-MS, MALDI-TOF-MS.
- Probe-MS (EI and CI ionization) and FIA-MS (ESI).
- Molecular characterization by low and high temperature SEC, coupled to UV/VIS, RI, IR, viscometry and MALLS; analytical and preparative TREF and bulk viscometry (Ubbelohde).
- Additive analysis using a reference database of over 1500 compounds.

Molecular Spectroscopy

- NMR spectroscopy, both liquid (up to 600 MHz) and solid state (400 MHz), various nuclei (¹H, ¹³C, ¹⁹F, ²⁹Si, ³¹P). Temperatures up to 140°C.
- Optical spectroscopy: FTIR, FTIR microscopy, FTIR imaging, rapid IR, ATR, FT-Raman, Raman microscopy, Raman imaging, UV/VIS.

Morphology and Surface Characterization

- Microscopy: Optical Microscopy, SEM and TEM (both with EDX elemental analysis).
- Chemical and physical surface analysis by AFM, XPS, TOF-SIMS and inverse gas chromatography (IGC).
- Molecular morphology: XRD: WAXS, SAXS, micro-XRD, real-time XRD and solid state NMR (e.g. network characterization).

Elemental Analysis and Classical Chemical Analysis

- Elemental analysis by XRF (WD and ED), micro-XRF, NAA, ICP-AES, ICP-MS, and organic EA (C, H, N analysis).
- Titration, density measurements, moisture determination, ash content, organic and inorganic carbon analysis.

Thermal Analysis

- Calorimetric: DSC, HPer DSC, microcalorimetry.
- Gravimetric: TGA, vacuum TGA, video imaging TGA.

Process Analysis

- In process analysis e.g. development of on-/in- and at-line analytical methods for bench, pilot and full scale plant environment by NIR, Raman, IR, GC, ultrasonic, conductivity and pH measurements.

Mathematics and Statistics

- White box modeling (reaction kinetics), numerical mathematics.
- Statistics: method validation, product and process consistency (MSPC), data mining, black and gray box modeling, chemometry (PLS, PCA, ...).

For further information:

P.O. Box 18, 6160 MD Geleen.
The Netherlands
info.resolve@dsm.com
www.dsm-resolve.com