

MATERIALS TESTING AND RESEARCH SOLUTIONS FROM AGILENT

Polymers and Rubbers Application Compendium

The Measure of Confidence



Agilent Technologies

MATERIALS TESTING AND RESEARCH SOLUTIONS

From the extraction of raw materials through the development, manufacturing and utilization of advanced materials, to material reuse and recycling, Agilent Technologies offers innovative, reliable analytical solutions for your business. Our comprehensive line of instruments for materials testing and research will ensure you consistently and cost-effectively deliver the highest quality finished products and materials.

Materials market overview

The materials market comprises the industries involved in the extraction of raw minerals from the earth (geosciences, mining and mineralogy) and the subsequent characterization and transformation of those raw minerals into metal alloys, ceramics, glass, and other engineered materials — described collectively as “advanced materials”. These advanced materials are developed with purpose specific characteristics and properties in a wide variety of industries.

Examples of advanced materials include:

- Aero and automotive (metals, composites)
- Polymers and composites
- Glass/ceramics/optics and photonics (lenses and coatings, eyewear)
- Specialty films and surface coatings (paint, adhesives, resins)
- Semiconductor and electronics (LEDs, LCDs, disk drives, thin-film electronics, fuel cells, solar cells)
- Textiles, paper and packaging
- Consumer goods (jewelry, gemstones, cosmetics)
- Construction (cement, architectural glass, metal alloys)



Materials market lifecycle

SOLUTIONS FOR POLYMERS AND RUBBERS

When accuracy and reliability in measuring the quality and chemical composition of plastics and polymers is critical to your success, choose Agilent.

Agilent molecular spectroscopy products provide the information required for development, QA/QC and to monitor the in-use service of these materials. Laboratory FTIR bench and microscopy systems provide insight into both bulk and detailed structure of polymers and rubber materials. Mobile FTIR spectroscopy affords non-destructive analysis of polymer, composite and rubber-based objects, regardless of location, shape or size.

In addition, Agilent atomic force microscopy (AFM) systems permit the detailed surface characterization of polymers and rubbers at the nanoscale. These high-precision, modular AFM systems offer industry-leading environmental/temperature control and electrical measurement capabilities to keep moving R&D forward. Agilent also offers an innovative, extremely compact field-emission scanning electron microscopy (FE-SEM) system optimized to provide high surface contrast using low-voltage imaging techniques. When mechanical properties characterization at the nanoscale is needed, user friendly Agilent nanoindentation systems ensure unrivaled accuracy and outstanding versatility.

Polymers and rubber are used across industry in an ever widening set of products and subassemblies. As synthesized materials, their properties, performance and longevity are directly related to achieving proper composition and structure. These materials have finite lifetimes, which are directly related to environmental affects, additives and stabilizers and overall usage.

Agilent solutions

Agilent FTIR spectrometers, microscopes and chemical imaging systems deliver:

- Detailed structural analysis of polymer and rubber based products.
- QA/QC support in the production of polymer and rubber.
- Defect analysis and analysis of layered materials via FTIR microscopy.
- Nondestructive, in situ analysis of polymer and rubber based objects in support of determining effect of use on longevity and performance.
- Handheld FTIR for nondestructive analysis of polymer, composites and rubber in any shape, size or location

Use Agilent LC systems for:

- Investigating very small differences between the chemical structures of polymers
- Analysis of additives in polymers, such as phenolic antioxidants and erucamide slip additives.
- Screening and qualitative identification of antioxidant polymer additives.

Agilent's GPC/SEC portfolio provides:

- High-performance analysis of engineering polymers such as PEEK and polybutylene terephthalate, polyolefins such as polyethylene and polypropylene, low molecular weight resins such as epoxy resins, polyesters and phenolic resins, or elastomers such as styrenebutadiene and natural rubber
- A comprehensive portfolio of GPC/SEC columns and calibrants for polymer analysis.

Agilent AFM and FE-SEM systems facilitate:

- Surface properties characterization in various environments (for example, heat, cold, gases).
- Electrical testing of charged polymers.

Agilent nanoindentation systems enable:

- Indentation and scratch testing of coatings on plastics.
- Mechanical properties characterization of tires, PVC, and polyethylene.

APPLICATIONS FOR POLYMERS AND RUBBERS

SPECTROSCOPY

Fourier Transform Infrared (FTIR) Spectroscopy

Quantitative Analysis of Copolymers Using the Cary 630 FTIR Spectrometer

Determination of Percent Polyethylene in Polyethylene/Polypropylene Blends Using Cast Film FTIR Techniques

Rapid Identification of O-rings, Seals and Gaskets Using the Handheld Agilent 4100 ExoScan FTIR

A New Approach to Sample Preparation Free Micro ATR FTIR Chemical Imaging of Polymer Laminates

Identification of Contaminants in Vehicle Fuel Tank Caps Using FTIR ATR-Microscopy

Component Failure Analysis of Vehicle Spark Plugs Using FTIR Spectroscopy With a Micro-ATR Large Sample Objective

Material Analysis by Infrared Mapping: A Case Study Using a Multilayer Paint Sample

Analytical Methods for the Agilent Cary 630 FTIR

Determination of Irganox 3114 in polypropylene by infrared spectroscopy

Determination of percent ethylene in ethylene-propylene statistical copolymers

Determination of Irganox 1010 in polyethylene by infrared spectroscopy

Determination of Irganox 1010 in polypropylene by infrared spectroscopy

Determination of the vinyl content of polyethylene resins

Determination of percent glycerol monostearate in polypropylene by infrared spectroscopy

Atomic Force Microscopy (AFM) and Field-Emission Scanning Electron Microscopy (FE-SEM)

Advanced Atomic Force Microscopy: Exploring Measurements of Local Electric Properties

Agilent 5600LS AFM High-resolution Imaging Molecular-level Understanding of n-Alkanes Self-Assembly onto Graphite

Several Aspects of High Resolution Imaging in Atomic Force Microscopy

Compositional Mapping of Materials with Single-Pass Kelvin Force Microscopy

Atomic Force Microscopy Studies in Various Environments

Young's Modulus of Dielectric 'Low-k' Materials

Nanoindentation

Nanoindentation, Scratch, and Elevated Temperature Testing of Cellulose and PMMA Films

Measuring the Complex Modulus of Polyethylene Using Instrumented Indentation

Complex Shear Modulus of Commercial Gelatin by Instrumented Indentation

APPLICATIONS FOR POLYMERS AND RUBBERS

CHROMATOGRAPHY

Liquid Chromatography (LC)

Sensitive Polymer Analysis using Critical Point Chromatography and ELSD

Analysis of Polymer Antioxidant Additives on the Agilent 500 Ion Trap LC/MS

Fast Analysis of Phenolic Antioxidants and Erucamide Slip Additives in Polypropylene Homopolymer Formulations Using 1200 Rapid Resolution Liquid Chromatography (RRLC) with Rapid Resolution High Throughput (RRHT) Columns and Method Translator

Analysis of Phenolic Antioxidant and Erucamide Slip Additives in Polymer by Rapid-Resolution LC

Developing a UHPLC Method for UV-based Detection and Quantification of Primary Aromatic Amines in Low Concentrations

Determination of Polymer Additives and Migration Products Prevalent in Food Packaging Material

Determination of Phthalate Migration From Toys

Analysis of Bisphenol A Leaching from Baby Feeding Bottles

High Sensitivity Analysis of Phthalates Using HPLC with Low Temperature Evaporative Light Scattering Detection

Agilent 1290 Infinity LC with Agilent Poroshell Columns for Simultaneous Determination of Eight Organic UV Filters

Gel Permeation Chromatography (GPC)

Stable Baselines in the Analysis of Poly(lactide-co-glycolide) Polymers by GPC with ELSD

Analyze Injection-Molding Polymers on Agilent PLgel 5 μ m MIXED-C by GPC

Artifact Free Analysis of Lignins by GPC using Agilent PolarGel-M

GPC and Agilent PolarGel-M Columns for the True Representation of Novolac Resins

Analysis of Polysaccharides by GPC Viscometry using the Agilent 390-MDS Multi Detector Suite

Characterization of Block Copolymers Synthesized via Transition Metal Mediated Living Radical Polymerization

Analysis of Biodegradable Polymers by GPC

Analysis of Poly(styrene/butadiene) Copolymers by Conventional Gel Permeation Chromatography on the Agilent PL-GPC 50 Plus

Size Exclusion Chromatography (SEC)

Size Exclusion Chromatography for the Analysis of Dental Polymers

SEC Analysis of a Water Soluble Copolymer

SEC Analysis of an Acrylamide Copolymer

GPC/SEC

Analysis of biodegradable polymers by GPC/SEC

Analysis of polyolefins by GPC/SEC

Analysis of engineering polymers by GPC/SEC

Analysis of elastomers by GPC/SEC

Low molecular weight resins and prepolymers

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