List of services

1.1 Testing site „Elastomer Analytics“

1.1.1 Chemical analysis of elastomers and failure analysis:

In principle, all the methods listed below can be tested according to standards other than those mentioned, according to customer procedures or according to procedures that are adapted to specific issues.

- FT-IR- and ATR-FT-IR analysis for identification of elastomers, polymers and other mixing components according to in-house method AA-3.2.1.1 / AA-3.2.1.2.
- Thermogravimetric analysis (TGA) for determining the quantitative composition of elastomers and other polymer materials according to DIN EN ISO 11358-1 / Volkswagen PV 3927 / in-house method AA-3.2.1.4.
- Dynamic scanning calorimetry (DSC) for the determination of thermodynamic properties according to DIN EN ISO 11357-2 / DIN EN ISO 11357-3 / ISO 28343 / in-house method AA-3.2.1.3.
- Qualitative GC-MS analysis for the identification of substances in extracts and eluates of elastomers and other polymeric (*).
- Determination of the content of extractable components according to ISO 1407:2023-04 (Procedure B) / FDA 21 CFR (*).
- Qualitative HS-GC-MS analysis for the identification of volatile substances from elastomers and other polymer materials (*).
- Comparative investigation of the cross-linking density of elastomers (*).
- Determination of the sulfur chain distribution / sulfur bridge length (*).
- Characterization of plastics and elastomers using pyrolysis-GC-MS according to in-house method (*) / Volkswagen PV 3935 (*).
- Microscopic investigation of the surface structure of elastomers and plastics (*).

In cooperation with Deutsches Institut für Kautschuktechnologie (DIK e.V.):

- Examination of the surfaces of materials and their composites as well as particles, etc. using scanning electron microscopy (SEM) (*).
- Determination of element distributions using EDS analysis (*).
- Comparative investigation of the chain mobility of elastomers using ^{1}H NMR relaxation time spectroscopy (*).

1.2 Testing site „Nitrosamine analysis“

1.2.1 Testing hazardous substances on elastomers and material samples:

- Analysis of elastomers and material samples using methanol extraction and GC-TEA for volatile and non-volatile N-nitrosamines according to in-house method AA-3.3.1.1.
- Determination of N-nitrosoamines and nitrosatable substances after migration in test solution e.g. saliva test solution according to DIN EN 12686 / DIN EN 29941(*).
- Determination of N-nitrosoamines and nitrosatable substances after migration in toys and toy parts made of elastomers according to EN 71-12 (*).

(*) Activities outside the scope of accreditation

1.2.2 Testing of air samples:

- GC-TEA analysis of Thermosorb tubes for volatile N-nitrosamines according to DGUV I 213-523 procedure 5-GC / IFA 8172 / in-house method AA-3.3.1.2.

1.3 Testing site „Polymer materials analytics“

1.3.1 Testing of polymer materials from the pharmaceutical and food sectors:

- Organic trace analysis in rubber and consumer goods.
- ”Leachables” and ”extractables” from polymer materials.
- Extraction/migration in various media in accordance with in-house procedures and in accordance with DIN EN 12873-1 (*) for migration in drinking water (drinking water directive) or BfR recommendation XXI (*).
- Analysis of polymer extracts for the identification and quantification of extracted and thermally labile components (*).
- Processing of migration water as well as identification and quantification of organic substances that can be leached by water in accordance with DIN EN 15768 (*) (drinking water directive).
- Sample preparation methods e.g. liquid-liquid extraction according to in-house method AA-3.4.1.4.
- Gravimetric determination of the non-volatile residue (NVR) according to in-house method AA-3.4.1.2.
- FT-IR analysis for the identification of main substance groups according to in-house method AA-3.4.1.1.
- ICP-MS analyses in cooperation with accredited external laboratory partner.
- Use of high-performance liquid chromatography (HPLC) with UV, DAD, VWD or RI detector to analyze compounds with medium to high molar masses down to the lower ppm range (*).
- Direct substance identification and quantification using high performance liquid chromatography (HPLC) coupled with photodiode array detector (PDA) and mass spectrometry (MS) according to in-house method AA-3.4.1.5 / AA-3.4.1.6 / AA-3.4.1.10.
- Gas chromatography (GC) analysis of low molecular weight and vaporizable compounds with MSD, FID or NPD detector (*).
- Substance identification and quantification by the use of Gas chromatography with MSD (GC-MS) according to in-house method AA-3.4.1.7 / AA-3.4.1.8.
- Additional GC analyses with programmed temperature vaporising (PVT) injector or pyrolysis (*).
- Headspace GC-MS analysis (vapor space analysis) for identification and quantification of volatile components according to in-house method AA-3.4.1.9.
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1.3.2 Testing for PAH contamination in material:

- Determination of PAH in carbon black according to ASTM 7771 (*) / ASTM D8143 (*).
- Determination of PAH in oils according to DIN EN 16143 (*).
- Determination of PAH in polymers according to AfPS GS PAK.

(*) Activities outside the scope of accreditation

1.4 Testing site “Materials testing“

1.4.1 Tests on elastomers/ plastics:

- Shore hardness according to DIN ISO 48-4.
- Microhardness - IRHD according to DIN ISO 48-2 (method M).
- Compression set according to DIN ISO 815-1.
- Creep and relaxation, plastic deformation according to VDA 675218 (*) / PV 3307 (*).
- Rebound resilience according to DIN 53512 / ISO 4662.
- Tensile strength, elongation at break, stress values according to DIN 53504 / ISO 37.
- Tear propagation resistance on strip samples according to DIN ISO 34-1.
- Abrasion resistance according to DIN ISO 4649 (method A).
- Artificial ageing, heat resistance according to DIN 53508 / ISO 188.
- Resistance to ozone cracking according to ISO 1431-1.
- Density according to DIN EN ISO 1183-1 (method A) / ISO 2781.
- Determination of the behaviour towards liquids according to DIN ISO 1817.
- Determination of the behaviour of elastomers at low temperature according to DIN 53545 (*).
- Determination of adhesion to rigid materials according to DIN ISO 813 (*).
- Separation test on adhesively bonded fabric layers according to DIN 53530 (*).
- Flexometer test according to DIN 53533-3 (*)/ ISO 4666 (*).
- Tensile set according to DIN ISO 2285 (*).
- Fatigue test (DeMattia) according to ISO 132 (*).
- Determination of stress relaxation under pressure according to DIN ISO 3384-1 (*).
- Weathering test – Xenon standard test according to DIN EN ISO 4892-2 (*) / DIN EN ISO 16474-2 (*).
- Weathering test – Xenon special test according to PV 3929 (*) / PV 3930 (*).
- Evaluation of the electrochemical resistance of hoses and materials of the cooling system, Brabbolyzer according to SAE J1684 (*).
- Testing according to automotive industry standards(*) according to VW (TL)/ Daimler (DBL)/ BMW (GS)/ others.

(*) Activities outside the scope of accreditation

1.4.2 Tests on compounds:

- Viscosity according to Mooney in accordance with DIN ISO 289-1.
- Scorch behaviour according to Mooney in accordance with DIN ISO 289-2.
- Vulcanisation behaviour according to DIN 53529-2 / DIN 53529-3 / ISO 6502-3.

1.5 “Application-specific Research“ in cooperation with DIK e.V. (*)

- Characterization of multiphase systems (morphology).
- Polymer-biofiller-systems.
- Polymer-filler interaction.
- Cross-linking.
- Application-specific material development.
- Ageing mechanisms.
- Modification of fillers and polymers.
- Nanomaterials (synthetic and bio-based).
- ”Leachables” and ”extractables” from polymer materials.
- Emissions and environmental exposure of elastomers.
- Transport processes of gases and liquids in elastomers.

1.6 Department „Processing Methodology“ (*)

- Strategies for discontinuous and continuous processes.
- Production of dynamic vulcanizates (TPE-V).
- Mixing, extrusion, calendering, injection moulding.
- Rheological behaviour and investigation of the processing behavior
- Process analysis and optimization.
- Process development.
- Production of test products.
- "Fused Filament Fabrication" for high viscous rubber compounds.
- "Direct Ink Writing" for low viscous rubber compounds.

1.7 Department „Material Concepts and Modeling“ in cooperation with DIK e.V. (*)

- Linear friction tester (LFT) for determination of friction properties at different conditions and according to ISO 15113:2005-10.
- Determination of abrasion behavior and traction indicators using VMI LAT 100 with variable conditions and according to ISO 23233:2009.
- Determination of different friction and traction (μ-slip curves) properties as well as abrasion (Coesfeld Friction and Wear Tester, prototype).
- Dielectric spectroscopy for polymer-filler investigations.

(*) Activities outside the scope of accreditation

- Microscopic surface analysis with atomic force microscopy (AFM) for surface roughness, filler distribution and dispersion.

1.8 Department „Elastomer Physics“ in cooperation with DIK e.V.(*)

- Fracture mechanics and fatigue.
- Life time prediction, e.g. crack propagation experiments.
- Acoustic damping and friction properties.
- Analysis of insertion, defects and analysis of crack initiation and propagation by using computer tomography (CT).
- Dynamic-mechanical analysis (DMA).
- Servohydraulic testing of parts in uniaxial, biaxial or torsional mode.

1.9 Department „Simulation and Continuum Mechanics“ in cooperation with DIK e.V.(*)

- Parameter identification of constitutive models for rubber for Finite Element Simulations.
  - Including but not limited to: hyperelasticity, viscohyperelasticity, material softening (Mullins Effect), temperature dependencies.
  - Associated material testing methods with usecase dependend test protocols: Uniaxial, equi-biaxial, pure shear multihysterisis experiments, DMTA, long time relaxation.
- Finite Element Simulation assisted reverse parameter identification on rubber parts with inhomogeneous strain.
- Custom Finite Element Analysis of customer articles and consulting.
- Development of constitutive models and implementation of material user subroutines for Abaqus (Simulia) and Marc (Hexagon).
- Multiphysics Simulation (Comsol), e.g. oxidative aging of elastomers.
- Multiscale models for foamed elastomers.
- Calibration of fatigue models for lifetime prediction and associated testing.

(*) Activities outside the scope of accreditation

Services of the DIK Testing Company

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