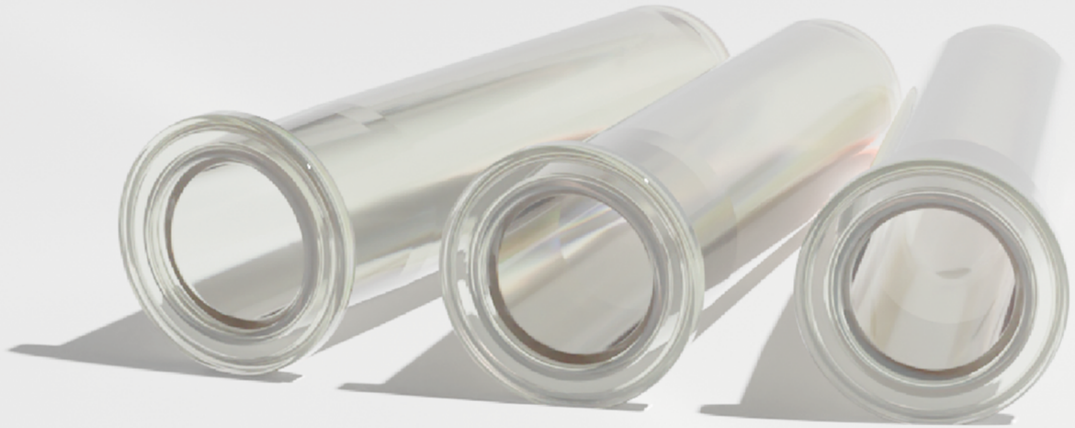
SANOK RUBBER



LABORATORY RESEARCH SERVICES

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- Determination hardness method ShA
- Determination hardness method IRHD method micro
- Determination of rebound resilience-method Schoba
- Determination of tensile strength, elongation and permanent at break
- Determination of tear strength
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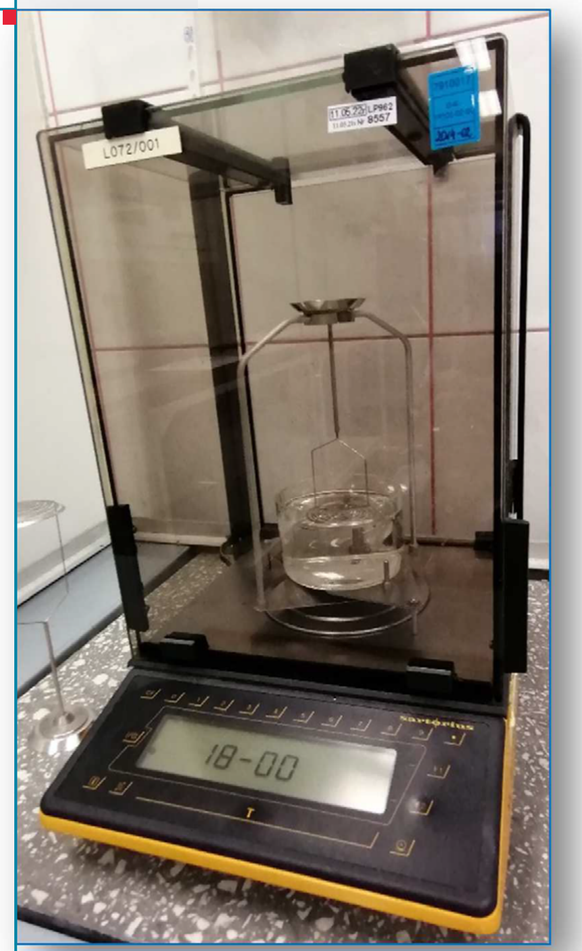
Determination density

Test name	Density
Standards	PN-EN ISO 1183-1;ISO 2781 method A
Subject of the test	Vulcanized rubber compounds, rubber products, plastic products
Test description	The test consists in determining the mass and volume of the tested sample and calculating its density
Test result	Density [g/cm³]
Equipment	Electronic balance Sartorius AC120S



Determination hardness method ShA

Test name	Density
Standards	ISO 48-4;PN-EN ISO 848
Subject of the test	Vulcanized rubber compounds, rubber products except sponge rubber, and plastic products
Test description	The test consists in measuring the resistance of the tested sample while plunging the needle into it. Hardness is inversely proportional to the size of the needle penetration. The conventional ShA hardness units cannot be compared with other hardness units. Measurements on standard samples with a thickness above 4 mm.
Test result	Hardness expressed in units ShA
Equipment	Durometer Bareiss HPE II

Determination hardness method IRHD method micro

Test name	Density
Standards	ISO 48-2
Subject of the test	Vulcanized rubber compounds, rubber products except sponge rubber and plastic products
Test description	The test consists in measuring the resistance of the tested sample while plunging the needle into it. Hardness is inversely proportional to the size of the needle penetration. The conventional IRHD hardness units cannot be compared with other hardness units. Measurements on standard samples with a thickness above 2 mm.
Test result	Hardness expressed in units IRHD
Equipment	Durometer Bareiss IRHD Micro Compact II

Determination of rebound resilience-method Schoba

Test name	Determination of rebound resilience -method Schoba
Standards	ISO 4662
Subject of the test	Vulcanized rubber compounds, rubber products. The method is used to the test rubbers in which the hardness is in the range of 30-80 IRHD, except sponge rubber.
Test description	The test consists in hitting a flat rubber sample with a spherical ending indenter attached to the pendulum with a weight of a certain mass falling by gravity from a specific position and reading the ratio of the height of the pendulum deflection to the height of its fall. The ratio is expressed as a percentage.
Test result	The rebound resilience [%]
Equipment	Elastometr ZWICK 5109

Determination of tensile strength, elongation and permanent at break

Test name	Tensile strength at break Elongation at break Elongation permanent at break
Standards	PN-ISO 37
Subject of the test	Vulcanized rubber compounds, rubber products.
Test description	Standard dumb-bell samples are stretched at a constant speed on a tensile testing machine. The test consists in stretching the sample until it breaks.
Test result	Tensile strength [MPa], elongation at break [%], permanent elongation at break [%], modulus 50, 100, 200 (the force required to stretch the sample by 50, 100, 200%)
Equipment	Tensile testing machine MTS Criterion 43.104E

DUMBLE BELL TYPE 1&2

Determination of tear strength

Test name	Tear strength, trouser, angle and crescent test pieces
Standards	PN-ISO 34-1; PN-ISO 34-2
Subject of the test	Vulcanized rubber compounds, rubber products
Test description	The test consists in stretching a standard sample with a deliberately made nick. During stretching, near the nick, significant stress concentration occur, leading to the destruction of the sample.
Test result	The ratio of the destruction force to the sample thickness [N/mm]
Equipment	Tensile testing machine MTS Criterion 43.104E

Determination accelerated ageing and heat resistance test

Test name	Accelerated ageing and heat resistance test
Standards	PN-ISO 188
Subject of the test	Vulcanized rubber compounds, rubber products
Test description	The test specimens are exposed to air at elevated temperature for a specified period of time. The physical properties are then determined and compared to the same properties of the samples than have not been aged [e.g. tensile strength, hardness, elongation at break, etc.]
Test result	Change the selected property
Equipment	Thermal chamber with air circulation in the temperature range 25-300 °C Apparatus for testing physical and mechanical properties.

Determination of resistance to ozone cracking

Test name	Resistance to ozone
Standards	ISO 1431-1
Subject of the test	Vulcanized rubber compounds, rubber products
Test description	The test consists in exposing the sample to ozone in the range of 25-200 pphm at a constant temperature. The time of the crack appearance and the degree of cracking are assessed.
Test result	Time, degree of cracking
Equipment	Ozone chamber TOYOSEIKI

Determination of the effect of liquids, including oil resistance

Test name	Determination of the effect of liquids, including oil resistance
Standards	PN-ISO 1817
Subject of the test	Vulcanized rubber compounds, rubber products, plastic products
Test description	The test specimen are subjected to the action of selected liquids/oils at elevated temperature for a specified period of time. Test liquids can be commonly used working liquids, such as: petroleum derivatives, organic solvents and chemical reagents. The material resistance to liquids is assessed by determining their properties before immersion in test liquids and after taking them out of the liquid (i.e. mass change, volume change, change in hardness, change in dimensions, change in tensile strength properties).
Test result	Change the selected property
Equipment	Thermal chamber with air circulation in the temperature range 25-300 °C. Apparatus for testing physical and mechanical properties.

Determination compression set

Test name	Compression set
Standards	PN-ISO 815-1;PN-ISO 815-2
Subject of the test	Vulcanized rubber compounds, rubber products, plastic products
Test description	In this test, a test specimen of know height is compressed to a specified degree of deformation and allowed to constant deformation for a specified time at the selected temperature, then the test specimen is allowed to elastically relax at a standard temperature for a specified time, and its height is re-measured.
Test result	Change the selected property
Equipment	Thermal chamber with air circulation in the temperature range 25-300 °C.

Determination of abrasion resistance using the Schoppera-Schlobacha apparatus

Test name	Abrasion resistance
Standards	PN-ISO 4649
Subject of the test	Vulcanized rubber compounds, rubber products except sponge rubber
Test description	The test consists in measuring the loss in volume of the rubber sample caused by rubbing it against a suitable abrasive covering the rotating drum of the apparatus.
Test result	Loss of sample volume [mm^3]
Equipment	Abrasion tester ZWICK 6102

Determination of low-temperature brittleness (impact method)

Test name	Brittleness temperature (impact method)
Standards	PN-ISO 812
Subject of the test	Vulcanized rubber compounds, rubber products
Test description	The test consists in measuring the lowest temperature at which the sample will not crack under the action of a dynamic force (impact) under specified conditions.
Test result	Temperature [°C]
Equipment	Apparatus for testing the brittleness temperature AM 80

Determination of low-temperature characteristics-Temperature - reaction procedure -TR test

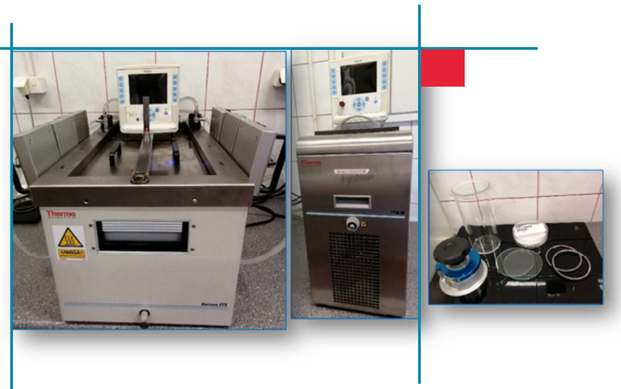
Test name	Determination of low-temperature characteristicstemperature reaction procedure- TR test
Standards	ISO 2921
Subject of the test	Vulcanized rubber compounds, rubber products
Test description	The test consists in stretching the sample, cooling it to an inelastic state, free relaxation of the sample with a simultaneous increase in temperature, and calculating the amount of deformation for different temperatures based on measurements of the sample length in specific temperature ranges.
Test result	Temperature [°C]
Equipment	Apparatus TR CEAST 6405

Determination of burning behaviour of interior materials

Test name	Burning
Standards	ISO 3795
Subject of the test	Vulcanized rubber compounds, rubber products, plastic products
Test description	The test consists in placing the sample horizontally in a U-Shaped holder and giving the effect a specific low-energy for 15 s in the combustion chamber.
Test result	Burning rate [mm/min]
Equipment	Combustion chamber model 11316

Determination of fogging characteristics-gravimetric method

Test name	Fogging
Standards	ISO 6452; DIN 75 201-B
Subject of the test	Vulcanized rubber compounds, rubber products, plastic products
Test description	The test consists in measuring the difference in weight between the aluminum foil with the haze sediment formed as a result of the condensation of volatile ingredients from the material, and the foil without the sediment.
Test result	Condensable constituents [mg]
Equipment	Apparatus Horizon FTS + Cooling bath HAAKE A28



Determination of the gloss of product coatings with a measuring geometry of 60°

Test name	Gloss with 60° measuring geometry
Standards	PN -EN ISO 2813
Subject of the test	Rubber products, plastic products with a coating
Test description	Gloss measurement consists in illuminating the surface with a special light source at a specific angle and measuring the intensity of radiation reflected from the tested surface.
Test result	Gloss units [GU]
Equipment	Glossmeter Rhopoint NOVO-GLOSS

Determination the colour measurement

Test name	Colour measurement
Standards	PN-EN ISO 11664-4
Subject of the test	Vulcanized rubber compounds, rubber products, plastic products
Test description	The measurement is performer in standard geometries 45/0, d/0 for various types of reflective and light diffusing materials. Colour measurement on a scale: CIE-L*a*b; XYZ
Test result	Colour unit
Equipment	Spectrophotometer SF80

Determination of the resistance of coatings to detachment from the substrate (Cross-cut test)

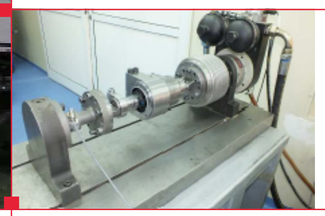
Test name	Resistance of coatings to detachment from the substrate (Cross-cut test)
Standards	PN-EN ISO 2409
Subject of the test	Rubber products, plastic products with a coating
Test description	The test consists in cutting a rectangular mesh on this coating, sticking an appropriate adhesive tape to the cut made and tearing the tape off the substrate at an appropriate angle.
Test result	Degree
Equipment	Cross-cut adhesion tester

Determination of resistance to weather conditions

Test name	Resistance to weather conditions
Standards	PN-EN ISO 4892-2, met. A
Subject of the test	Rubber products, plastic products
Test description	The test consists in exposing the sample to the light of a xenon lamp, appropriate temperature, humidity and raining for a specified number of hours. The resistance to weather conditions is assesses by comparing the colour change of the exposed test sample to the unexposed sample using the grey scale acc.to ISO 105-A02, or using the instrumental method acc.to DIN EN ISO 11664-4.
Test result	Grey scale degree or colour scale measurement: CIE-L*a*b; XYZ
Equipment	Apparatus Xenotest Alpha

Measurements of static characteristics up to 100kN or 500Nm / 50°

Test name	Measurements of static characteristics up to 100kN or 500Nm / 50°
Standards	Testing according to the submitted documentation
Subject of the test	Rubber products, rubber-metal products, rubber-plastic products
Test description	The test consists in compression or tensile of the test sample and deterination of static characteristics and static stiffness in the radial, axial, torsional or conical directions. The test can be performed at temperatures from -40°C to + 200°C.
Test result	Static Characteristic [graph], Static Stiffness [N/mm] or [Nm/°]
Equipment	Testing machines with special fixture: MTS 810 Elastomer; MTS 831 Elastomer; MTS Insight 100SL; Instron 4467, Rotary actuator IST, Temperature chamber: Tira AT600; MTS 651

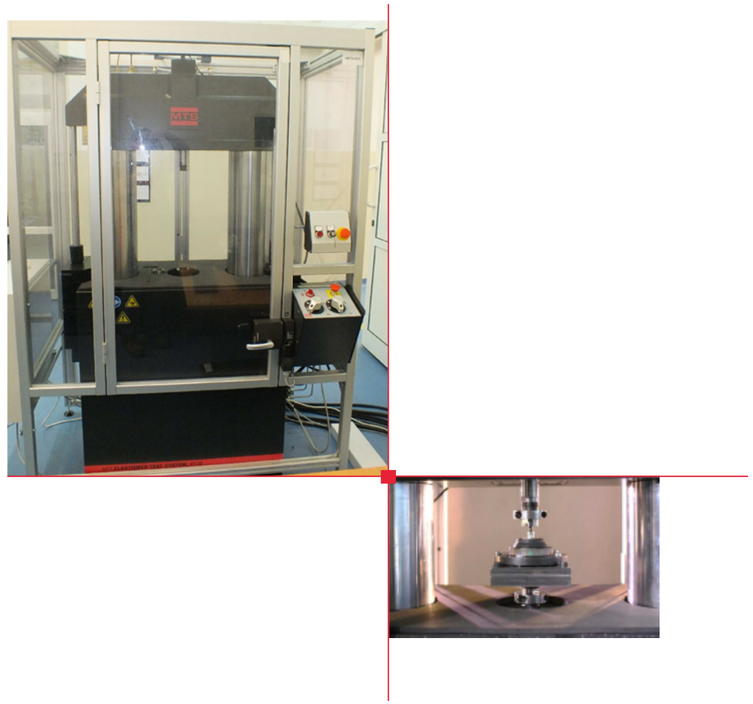


Creep test up to 50kN

Test name	Creep test up to 50kN
Standards	Testing according to the submitted documentation
Subject of the test	Rubber products, rubber-metal products, rubber-plastic products
Test description	The test consists in loading the sample with a constant force or constant displacement for a given time and determining the change of displacement or force, respectively. The test can be performed at temperatures from -40°C to + 200°C.
Test result	Change of displacement [mm] or force [N]
Equipment	Creep tester: Zwick Kappa 50 DS Temperature chamber: Tira AT600; MTS 651

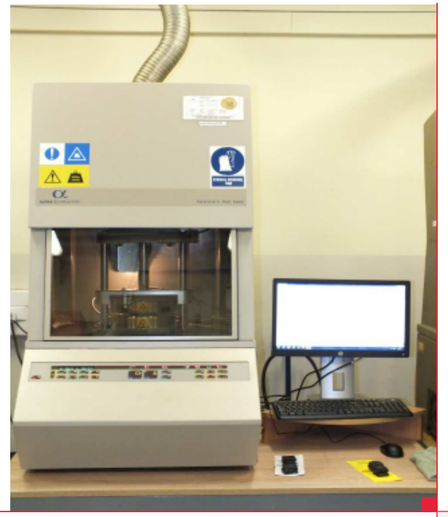
Dynamic stiffness and Loss angle measurements up to 400Hz

Test name	Dynamic stiffness and Loss angle measurements up to 400Hz
Standards	Testing according to the submitted documentation
Subject of the test	Rubber products, rubber-metal products, rubber-plastic products
Test description	The test consists in applying a given preload to the tested sample, and then starting oscillation with the displacement or force excitation with a given frequency, and determining the dynamic stiffness K* and the loss angle. It is also possible to determine other dynamic parameters such as K ,, K' ,, C, E *, E', E ,' ,, Energy, Tan Delta or the relationship between the dynamic stiffness and the static stiffness - Rd. The test can be performed at temperatures from -40°C to + 200°C.
Test result	Change of displacement [mm] or force [N]
Equipment	Creep tester: Zwick Kappa 50 DS Temperature chamber: Tira AT600; MTS 651



Determination of Mooney viscosity

Test name	Determination of Mooney viscosity
Standards	PN-ISO 289-2
Subject of the test	Rubber compounds
Test description	The test consists in placing the sample in a chamber with a specific temperature and measuring the torsional moment of the sample during the oscillation of the rotor in the chamber.
Test result	Mooney Viscosity [MU], Scorch time T5 [s]
Equipment	MOONEY VISCOMETER MV2000

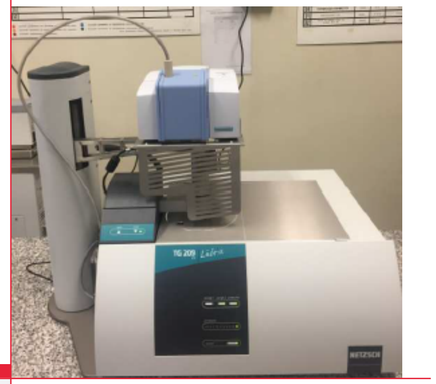


Measurement of vulcanization characteristics

Test name	Measurement of vulcanization characteristics
Standards	PN ISO 6502
Subject of the test	Rubber compounds
Test description	The test consists in placing the sample in a chamber with a specified temperature and measuring the torsional moment of the sample during the oscillation of the rotor in the chamber.
Test result	Marameters: ML, MH; ts2, t10, t50, t90; PL, PH, t@MPR
Equipment	Reometr MDR 2000

TGA identification test

Test name	Analysis of the qualitative and quantitative composition using the TGA thermogravimetric method
Standards	ASTM D 6370-2019, ISO 9924-2:2000, Own methodology
Subject of the test	Rubber compounds, rubber products, plastic products
Test description	Investigation of physical processes and chemical reactions related to the change of mass when heating a sample to 1000°C
Test result	TG thermogram - graph of mass change [%] as a function of time [t] or temperature [°C]
Equipment	Thermogravimeter TG 209 F1 Libra



ATR identification test

Test name	ATR spectra analysis
Standards	ASTM D 3677-2010 (2019), ISO 4650-2012
Subject of the test	Rubber compounds, rubber products, plastic products
Test description	Qualitative analysis - measurement of solid and liquid samples using the weakened total IR light reflection technique
Test result	IR spectrum - absorbance / transmittance curve as a function of wavenumber [cm^{-1}]
Equipment	Alpha-P spectrometer by BRUKER

Extrudability of Unvulcanized Compounds

Test name	Extrudability of Unvulcanized Compounds
Standards	ASTM D 2230
Subject of the test	Rubber compounds
Test description	Extruding the mixture in the form of a profile
Test result	recording of stamping parameters, density and visual evaluation of the profile.
Equipment	Extruder Rubicon EEK.32

Homogenization test of the rubber compounds

Test name	Evaluation of homogenization and purity of the rubber compound
Standards	Own methodology
Subject of the test	Rubber compounds
Test description	Visual analysis of the surface of the embossed strips - identification of inclusions
Test result	Evaluation of inclusions
Equipment	Keyence VHX900 digital microscope

Checking the scales

Test name	Checking the scales
Standards	LP 03/03
Subject of the test	Non-automatic electronic scales
Test description	Comparison of scale readings with weight standards
Test result	Determination of weight error at measuring points
Equipment	Set of weights

Checking the temperature sensors

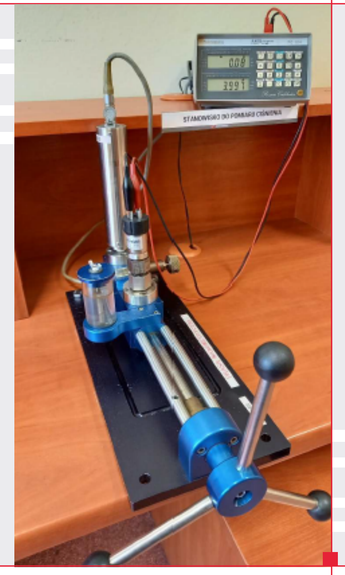
Test name	Checking the temperature sensors
Standards	LP 03/04
Subject of the test	Temperature sensors
Test description	Warming up the temperature sensor in the calibration oven and checking the readings with the temperature calibrator
Test result	Determination of the sensor error at the measuring points
Equipment	Calibration oven FB 150 Calibrator MC 5

Checking the calipers

Test name	Caliper check
Standards	LP 03/01
Subject of the test	Caliper up to 150 mm
Test description	Comparison of calliper and gauge block values
Test result	Determination of calliper error at measuring points
Equipment	Ceramic gauge blocks for calipers

Checking the pressure gauges

Test name	Checking the pressure transducers
Standards	LP 03/02
Subject of the test	Pressure transducers / current
Test description	Simulation of the pressure in the press and comparison of the readings with the pressure calibrator
Test result	Determination of indication errors calculated in percent by the pressure calibrator
Equipment	Pressure calibrator TC 104 Manometric press

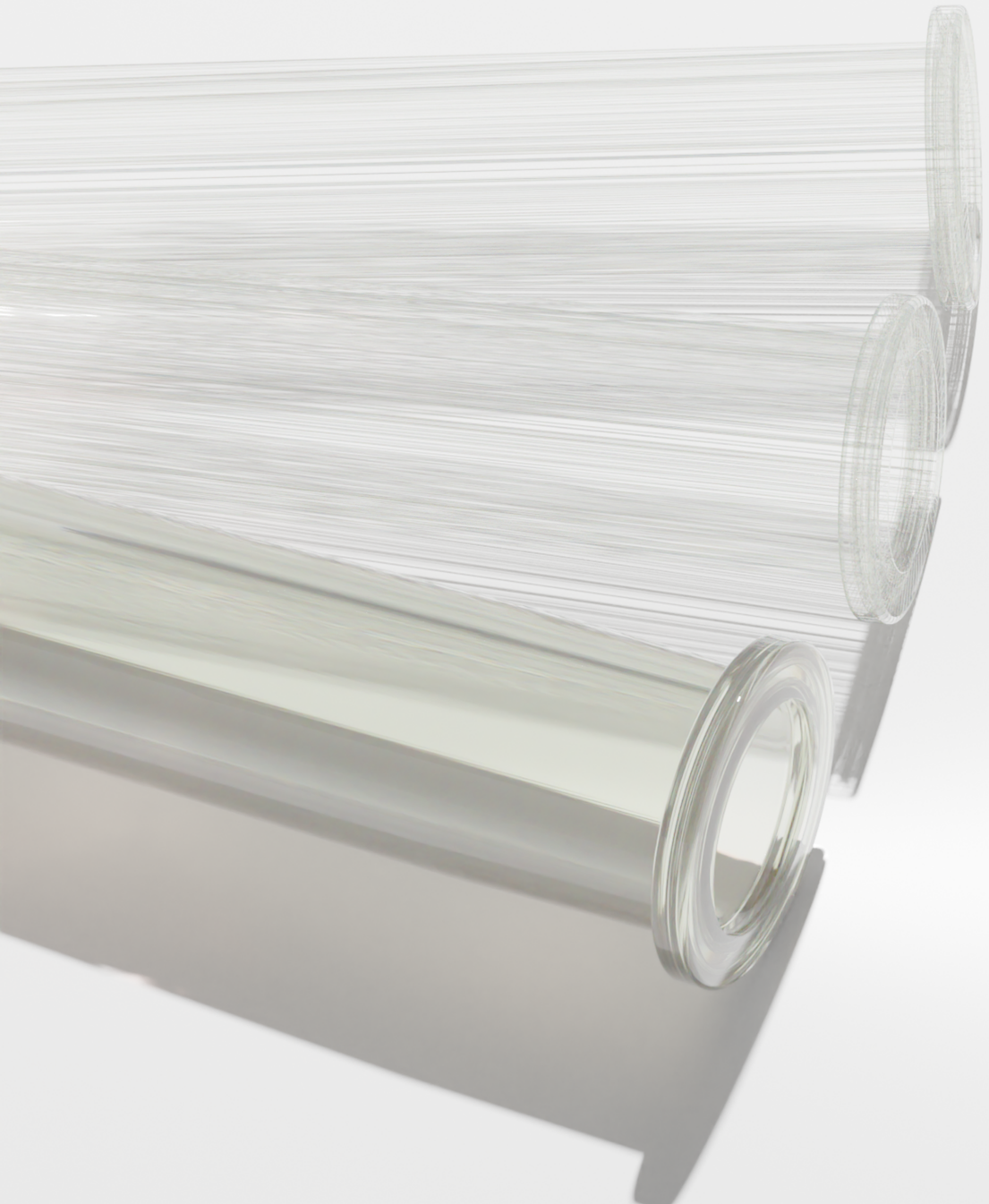


Determination of the suspended solids

Test name	Suspension
Standards	PN-EN 872:2007/Ap1
Subject of the test	Water, sewage
Test description	The test consists in the determination of the suspended matter in the sample by the weight method, by filtration through glass fiber filters.
Test result	Content in mg/l
Equipment	Electronic balance AE 240

Determination of the chemical oxygen demand

Test name	Chemical oxygen demand
Standards	PN-ISO 15705:2005
Subject of the test	Water, sewage
Test description	The test consists in measuring the amount of oxygen dissolved in water needed for the oxidation of chemical organic matter.
Test result	Content in mg/l
Equipment	Spectrophotometer DR 3900



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