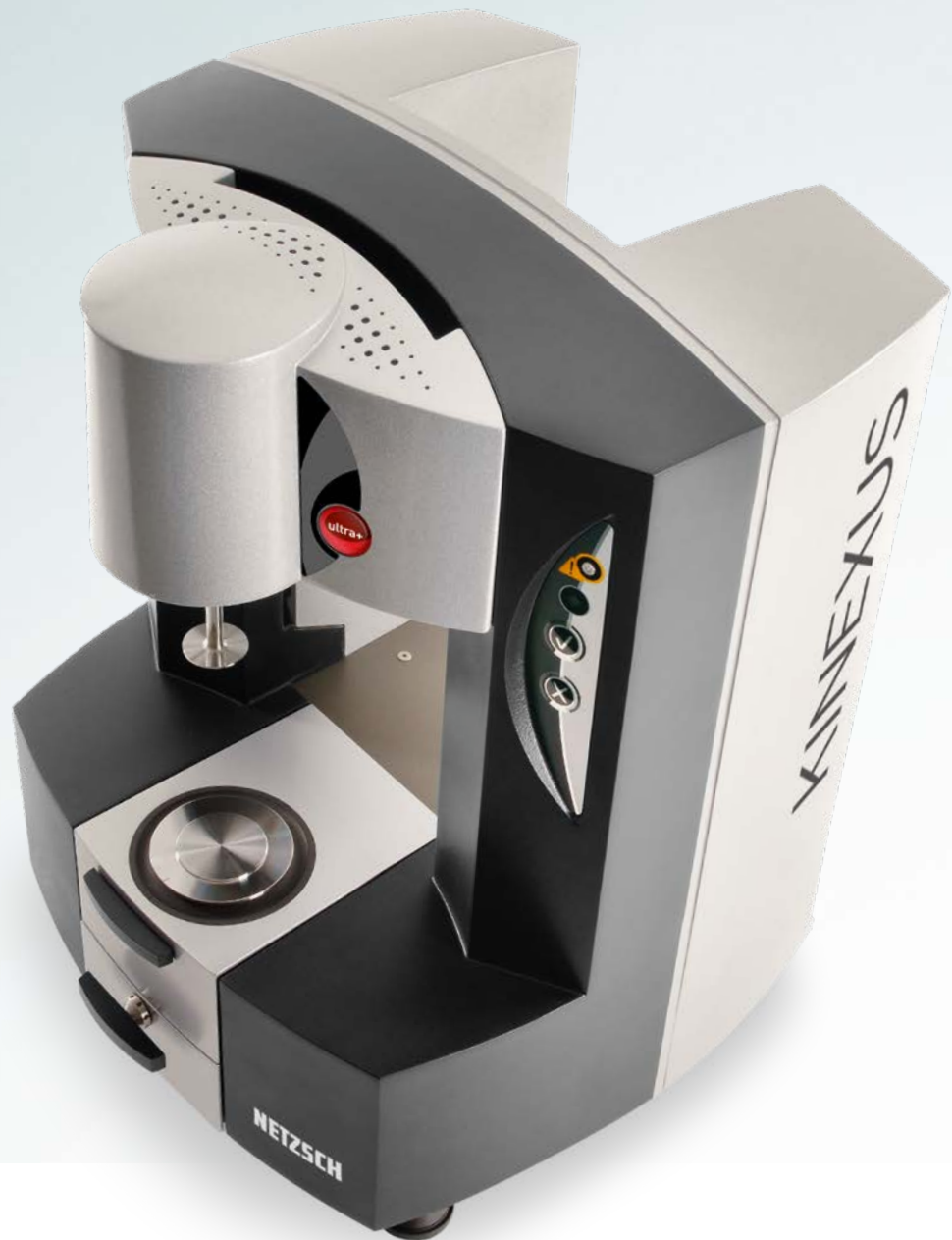


NETZSCH

Proven Excellence.



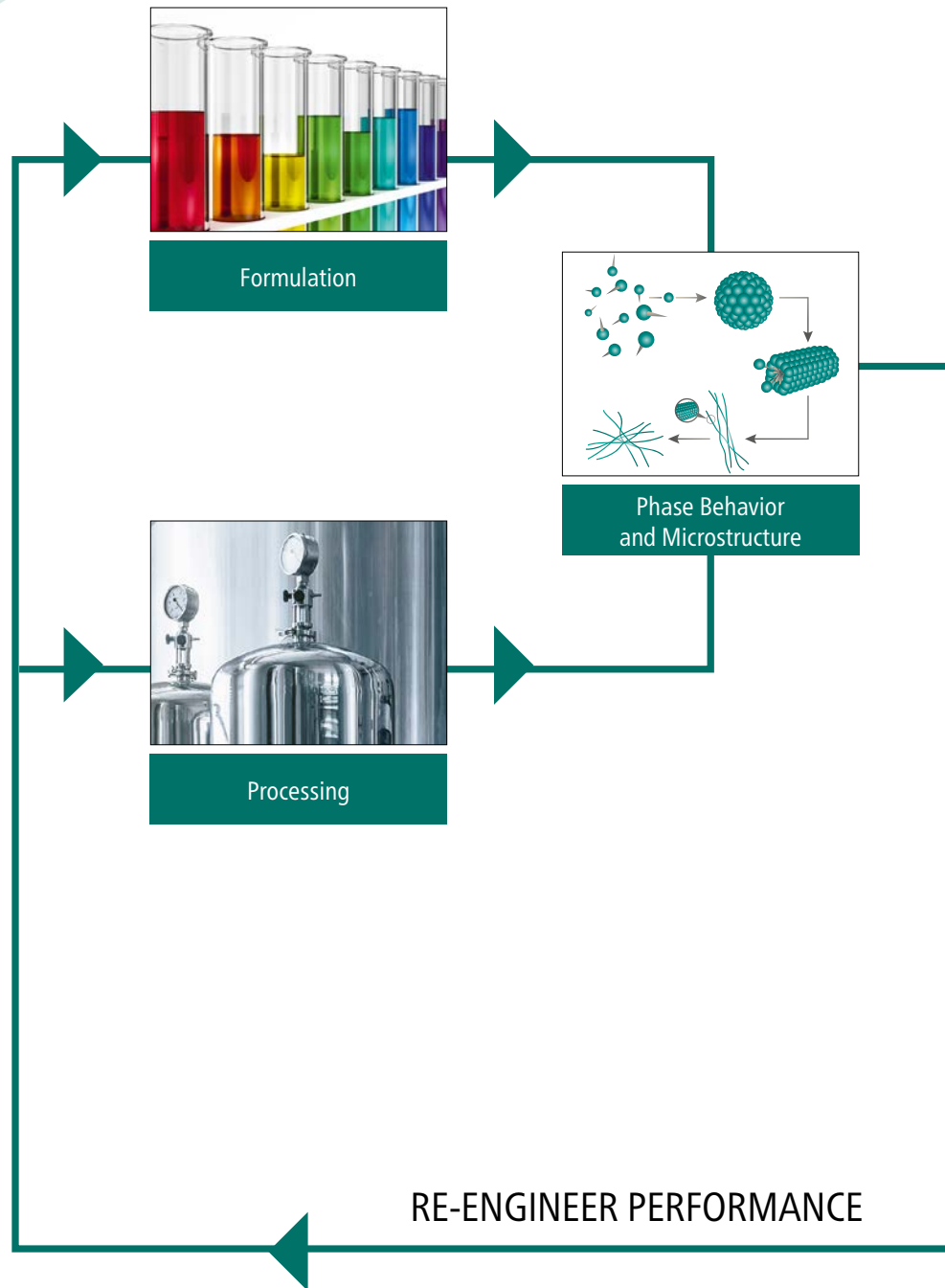
Kinexus Series

Redefining Rheometer Capabilities

Analyzing & Testing

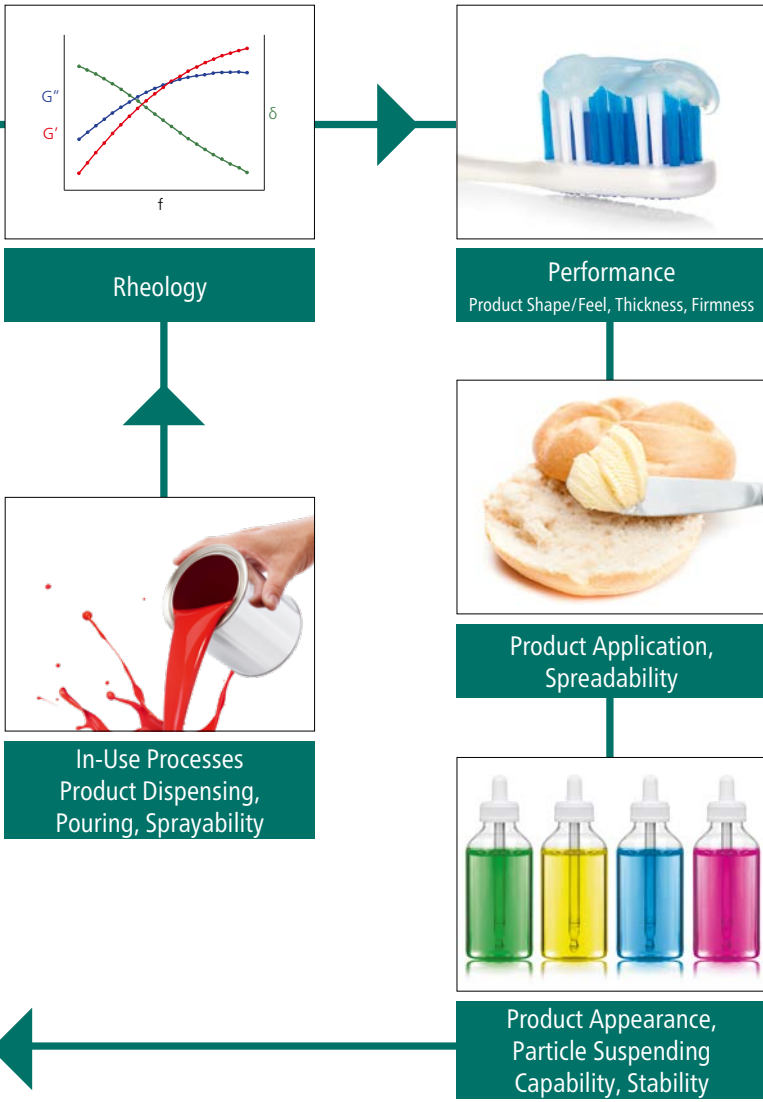
FROM FORMULATION AND PROCESSING TO END-USE

The Importance of Rheology



PRODUCT PERFORMANCE

Rheology provides an important link between product microstructure and performance. A formulators' goal is to produce a product which meets the desired performance criteria by controlling its microstructure and ultimately its rheology.



The Kinexus rheometer helps you define and understand material characteristics – from viscosity to viscoelasticity – and solve material problems at all stages of the product life cycle:

- As part of a manufacturing process
- Over a particular timescale or a particular temperature range
- With a particular sample batch
- With a change in formulation
- With packaging the material
- With transportation of the material
- With product stability or storage shelf-life
- With aspects of end-use performance
- With consumer acceptance of a product
- With comparison to other products available in the marketplace

Kinexus Series

Redefining Rheometer Capabilities for Characterizing Dispersed Systems



The Kinexus isn't just a rheometer – it is redefined the way it interacts with you. Kinexus is the next generation rotational rheometer platform that's been developed from extensive market feedback, integrating innovative instrument design with a revolutionary software interface, to deliver a solution that will exceed your rheological expectations.

A modular rheometer with true *plug and play* functionality for all measuring systems and environmental control units, Kinexus enables pioneering Standard Operating Procedure (SOP) driven rheological testing.

Targeted at the characterization of dispersions and other complex fluids and soft solids, the Kinexus rheometer has unprecedented dual-action capabilities for both shear and vertical (or axial) testing.



Environmental cartridges are easily changed or removed for service

- All modes of operation – stress control, shear rate control and direct strain controlled oscillation at demand strain amplitude – for accurate control of sample strain history
- Exceptional vertical travel and gapping capabilities with ultra-responsive and highly sensitive Normal Force for class-leading performance
- Unique rSpace software interface that offers total flexibility of test set-up – from sequence-driven Standard Operating Procedure (SOP)-type functionality to fully customizable test design for advanced research capabilities
- Wide variety of measurement geometries optimized for rheological characterization of complex fluids and soft solids, including dispersions, emulsions, polymer and surfactant solutions, pastes and gels
- Intelligent geometry recognition with full auto-configuration and user feedback on system status to guarantee robust data for all measurements
- Complete sample history from the point of loading onto the rheometer available in data file as standard – because ensuring reliable rheology data for complex non-Newtonian materials actually starts before a measurement takes place
- Unique *plug and play* cartridge system for all environmental controllers – all mechanical, power, communication and fluid connections made in one simple action
- Multifunctional accessory design – plate cartridges with interchangeable lower plates for a cost-effective solution addressing the widest application coverage

Key Benefits of Kinexus Rheometer

Unprecedented Dual-Action Capabilities

A Revolution in Shear and Vertical (Axial) Test Control

The unique combination of Kinexus hardware technology and rSpace software gives the user the ability to configure three critical rheometer functions independently:

- Rotational (shear) control - torque, speed and position
- Vertical (axial) control – gap and Normal Force
- Temperature control

Offering the ultimate in rheological test flexibility for both industry and academia, Kinexus enables:

- All rotational shear-based testing
- Advanced vertical (axial) testing including squeeze flow and tack testing
- A combination of shear and vertical actions for revolutionary process-relevant measurements

Significant design effort has been directed at the vertical, or axial capabilities of the Kinexus platform – an area that typically sees compromises on most rheometer systems.

Kinexus combines high speed and ultra-fine resolution gap control with high sensitivity and ultra-responsive Normal Force control for truly innovative sample loading and measurement capabilities – from sensitive structures to rapid curing systems.

Allied to *cradle to grave* data collection providing a complete sample history from loading to unloading, every aspect of rheological testing can be optimized and verified for total consistency.



Unprecedented Dual-Action Capabilities

Using Synchronized Torque, Displacement, Gap and Normal Force Data at Ultra-High Rates



Gap Control

- Exceptional vertical travel range of 230 mm for maximum user access and flexibility of test setup
- Unmatched vertical speed range from 0.1 $\mu\text{m/s}$ to a maximum 35 mm/s
- Controllable speed and Normal Force profiles over full range of vertical travel - linear, exponential and max/min limited
- Gap measured to 0.1 μm over full range
- Optimal sample loading for all material types – from sensitive strain-critical structures to rapid curing systems
- Highly controllable axial test capabilities – squeeze flow and tack tests

Normal Force

- High sensitivity and rapid response times from a novel strain gauge design
- More controllable and reactive system designed to capture transient material responses
- Ultra-fast, constant streaming data update rate of 5 kHz for all instrument variables, including gap and Normal Force – synchronized with rotational and temperature data
- Normal Force data captured and stored during sample loading process – because robust rheology for non-Newtonian materials starts with a consistent and controllable sample loading process



MEASURING SYSTEMS AND ACCESSORIES

Measuring Systems

- Quick-connect geometries with intelligent auto-recognition
- Geometry constants and test preferences automatically configured
- Lock-down tests to specific geometry to minimize operator error
- Automated geometry lock via software for ease of trimming
- Various material and surface finish options
- Solvent trap compatible
- Disposable options
- Coaxial cylinders (cup and bob) to DIN standard
- Double gap cell and vane tool options
- Geometry adapter allows use of custom geometries with Kinexus

Environmental Controllers

- Exclusive *plug and play* cartridge design
- Quick, easy and robust insertion
- All mechanical, power, communication and fluid connections made in one action
- Automatic cartridge recognition and configuration
- Peltier-based systems provide high heating and cooling rates with excellent temperature stability
- High accuracy temperature sensor in close proximity to the sample
- Temperature resolution to 0.01°C
- Easy-to-clean designs

Peltier Plate Cartridge (-40°C to 200°C)

Environmental controller for
cone-plate and parallel plate
measuring systems

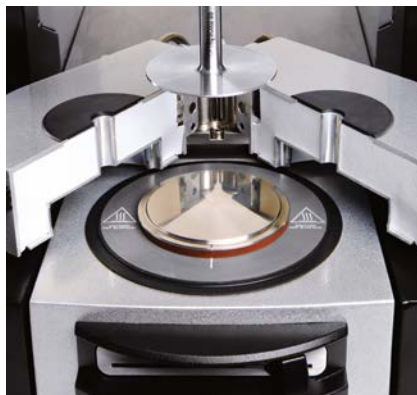
- Meets the temperature control requirements for the majority of applications from fluids to soft solids, such as creams, pastes and gels
- Interchangeable lower plates enable optimal geometry choice, e.g., match lower pedestal diameter for self-supporting samples, without compromising thermal performance
- Efficient solvent trap design for accurate measurement of samples with volatile components and to minimize sample drying
- Disposable plate option for curing materials



Active Hood Cartridge (-40°C to 200°C)

Environmental controller with
minimized thermal gradients
for plate measuring systems

- Applicable to the measurement of highly thermally-sensitive samples, and for temperature-critical testing where the temperature range is significantly above or below ambient
- Proprietary design combines Peltier elements with additional heaters to actively control radial and vertical thermal losses from the local sample environment
- Low thermal mass components for rapid response
- Inlet for inert gas feed into sample environment



Peltier Cylinder Cartridge (-30°C to 200°C)

Environmental controller for
concentric cylinder-type
measuring systems

- Options to meet temperature control requirements for materials from highly fluid-like samples through to high concentration yield stress dispersions
- Twin Peltier design for rapid temperature changes and sample equilibration, and minimized thermal gradients
- Various cup and bob sizes available – C14 (DIN), C25 (DIN) and wide diameter C34
- Double gap cell and vane tools
- Interchangeable lower cups with removable base for ease of cleaning
- Plate insert provides a *universal Peltier option*



Designed for the Rheological Testing
of Complex Fluids and Soft Solids

rSpace Software



Experience the Ultimate in Test Flexibility with Sequence-Driven Rheometer Control

One of the key development aims for the Kinexus rheometer was to deliver a system that enabled total flexibility of control – to provide unique test capabilities that went beyond those previously available on rotational rheometer systems.

Market feedback was reporting that industrial users would like the option to run under Standard Operating Procedure (SOP)-driven protocols, with *locked down* tests that included specific user instructions and inputs to meet their particular requirements.

At the other extreme, university researchers were asking for a completely open *programming-type* test capability that would allow them to link instrument or rheological actions together in ways that *thought experiments* allowed, but not their rheometer interface.

The challenge for rSpace software was to successfully reconcile these needs. Kinexus is unique in that the software user interface is sequence-driven, and it is this concept that meets both of the above requirements.



rSpace software is driven by *sequences* – which consist of fundamental rheological actions (or test building blocks) that can be linked together with other test actions, such as user feedback and choices, calculate values, loops and triggers, in order to build *intelligent* tests.

- Set a sequence to *run* only, and a user operates under SOP-type conditions with defined test instructions and feedback
- Set user access to *edit* sequence functionality, and researchers have the full design capabilities at their fingertips

What Rheological Test Progression Would You Like to Run?

- You think it – Kinexus can run it
- Dedicated and advanced tests exactly to your needs

Program Sequence in Kinexus

- *Drag and drop* actions and *Import subsequence* functionality
- Include user choices, calculate values, loops, triggers
- Include specific user inputs and instructions as required

Standard Operating Procedure (SOP) Driven Tests for Robust Rheological Measurements

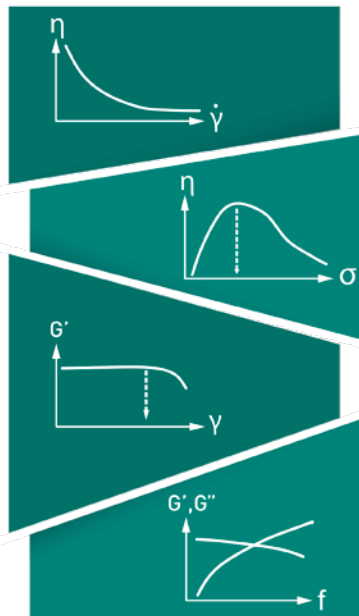
The Standard Operating Procedure (SOP) approach to material testing has been a corner stone to all our technologies, and is now available for the first time on a rheometer system.

- Lock-down tests including geometry and parameter set-up
- Continuous feedback and user guidance
- Produce standard test methods
- Available for use company-wide
- Consistent testing as standard



Rheology Toolkit

- Series of fundamental rheological tests available in rSpace at the click of a mouse
- Get started with robust rheology testing
- Fully configured SOP-driven tests with associated test description



Use Toolkit Tests to Solve Your Material Puzzles:

- Build up a *picture* of the overall rheology of a material
- Find an answer to material formulation, application or process problems
- Target optimization of a key material characteristic, or implementation of a critical diagnostic test

Technical Specifications

Kinexus			
	ultra+	pro+	lab+
Rheometer platform	Highest specification bearing available for advanced testing	Meeting rheological needs in research and development	Standard Operating Procedure (SOP) testing for quality control
Standard operating modes	Direct strain control; shear rate control; shear stress control		
Torque range – viscometry (rate and stress control)	1.0 nNm – 250 mNm	5.0 nNm – 225 mNm	10 nNm – 200 mNm
Torque range – oscillation (strain and stress control)	0.5 nNm – 250 mNm	1.0 nNm – 225 mNm	5.0 nNm – 200 mNm
Torque resolution	0.05 nNm	0.1 nNm	0.1 nNm
Position resolution	< 10 nrad	< 10 nrad	< 10 nrad
Angular velocity range	1 nrad ^s ⁻¹ to 500 rad ^s ⁻¹	1 nrad ^s ⁻¹ to 500 rad ^s ⁻¹	10 nrad ^s ⁻¹ to 325 rad ^s ⁻¹
Step change in strain	< 10 ms	< 10 ms	< 10 ms
Frequency range	6.28 μrad ^s ⁻¹ to 942 rad ^s ⁻¹ (1 μHz to 150 Hz)	6.28 μrad ^s ⁻¹ to 942 rad ^s ⁻¹ (1 μHz to 150 Hz)	6.28 μrad ^s ⁻¹ to 628 rad ^s ⁻¹ (1 μHz to 100 Hz)
Motor inertia	12 μN.m.s ²	12 μN.m.s ²	12 μN.m.s ²
Normal force range	0.001 N – 50 N	0.001 N – 50 N	0.001 N – 50 N
Normal force resolution	0.5 mN	0.5 mN	0.5 mN
Normal force response time	< 10 ms	< 10 ms	< 10 ms
Vertical lift speed	0.1 μm ^s ⁻¹ to 35 mm ^s ⁻¹	0.1 μm ^s ⁻¹ to 35 mm ^s ⁻¹	0.1 μm ^s ⁻¹ to 35 mm ^s ⁻¹
Vertical lift range (measurable)	230 mm	230 mm	230 mm
Gap resolution (over full vertical lift range)	0.1 μm	0.1 μm	0.1 μm
Fully configurable vertical profiles	By speed and by Normal Force		
Raw instrument variables	5 kHz constant streaming data		
Complete sample history	Data available from loading to unloading as standard		
Instrument interface	USB2 – plug and play		
rSpace software	Sequence-driven user interface enabling Standard Operating Procedure (SOP)-type test functionality and fully customizable test designs		
21 CFR part 11 software	Optional	Optional	Optional
Dimensions	D x W x H (weight): 485 mm x 490 mm x 680 mm (47 kg)		

Understanding the application under consideration, and the associated rheological test requirements, is a key factor in selecting the most appropriate rheometer system.

If you are unsure as to specifying an appropriate rheometer model for your application, NETZSCH recommend contacting us for further advice and/or a sample test and evaluation report.

Kinexus	
	ultra+ pro+ lab+
Accessories	Designed for dispersed systems characterization – including polymer and surfactant solutions, foams, emulsions, suspensions, pastes and gels
Measuring systems (geometries)	
Quick-connect upper geometries	Plug and play; auto-recognition and configuration in software
Material	Stainless Steel 316 as standard Other options are available, e.g., for chemical compatibility (titanium)
Plate and cone diameter	20 mm through to 60 mm as standard size range – other sizes on request 4 mm, 8 mm and 25 mm plates specifically designed for Asphalt testing
Cone angle	0.5°, 1°, 2° and 4° variants – other angles on request
Interchangeable lower plates	Varying diameters and surface finishes (to match upper geometries)
Concentric cylinders	C14 (DIN), C25 (DIN), C34 as standard
Interchangeable cups	Quick release/engage mechanism
Surface finish options	Roughened (sand blasted); serrated; splined or grooved (cup and bobs)
Vane tools	C14 and C25 vane tools
Disposable option	Upper and lower disposable plate options for curing materials
Environmental controllers	
Quick-connect cartridge system	Plug and play; auto-recognition and configuration in software
Peltier plate cartridge	Temperature range: -40°C to 200°C Maximum heating rate*: 30°C/minute Maximum cooling rate*: 30°C/minute
Active Hood Peltier plate cartridge	Temperature range: -40°C to 200°C Maximum heating rate*: 30°C/minute Maximum cooling rate*: 20°C/minute
Peltier cylinder cartridge	Temperature range: -30°C to 200°C Maximum heating rate*: 15°C/minute Maximum cooling rate*: 15°C/minute
Temperature resolution	0.01°C
Temperature stability	Better than ± 0.1°C

* Temperature range dependent.

NOTE: Specifications have been obtained under conditions as stated in the Installation and Site Requirements for Kinexus rheometers



Expertise in Service

Our Expertise – Service

All over the world, the name NETZSCH stands for comprehensive support and reliable service, before and after sale. Our qualified personnel from the technical service and application departments are always available for consultation.

In special training programs tailored for you and your employees, you will learn to tap the full potential of your instrument.

To maintain and protect your investment, you will be accompanied by our experienced service team over the entire life span of your instrument.

Our Expertise – Applications Laboratories

The NETZSCH Thermal Analysis applications laboratories are a proficient partner for nearly any Thermal Analysis issue. Our involvement in your projects begins with proper sample preparation and continues through meticulous examination and interpretation of the measurement results. Our diverse methods and over 30 different state-of-the-art measuring stations will provide ready-made solutions for all your thermal needs.

Within the realm of thermal analysis and the measurement of thermo-physical properties, we offer you a comprehensive line of the most diverse analysis techniques for materials characterization.

Measurements can be carried out on samples of the most varied of geometries and configurations. You will receive high-precision measurement results and valuable interpretations from us in the shortest possible time. This will enable you to precisely characterize new materials and components before actual deployment, minimize risks of failure, and gain decisive advantages over your competitors.

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The NETZSCH Group is an owner-managed, international technology company with headquarters in Germany. The Business Units Analyzing & Testing, Grinding & Dispersing and Pumps & Systems represent customized solutions at the highest level. More than 3,700 employees in 36 countries and a worldwide sales and service network ensure customer proximity and competent service.

Our performance standards are high. We promise our customers Proven Excellence – exceptional performance in everything we do, proven time and again since 1873.

When it comes to Thermal Analysis, Calorimetry (adiabatic & reaction) and the determination of Thermophysical Properties, NETZSCH has it covered. Our 50 years of applications experience, broad state-of-the-art product line and comprehensive service offerings ensure that our solutions will not only meet your every requirement but also exceed your every expectation.

Proven Excellence.■

NETZSCH-Gerätebau GmbH
Wittelsbacherstraße 42
95100 Selb
Germany
Tel.: +49 9287 881-0
Fax: +49 9287 881 505
at@netsch.com

NETZSCH®

www.netsch.com