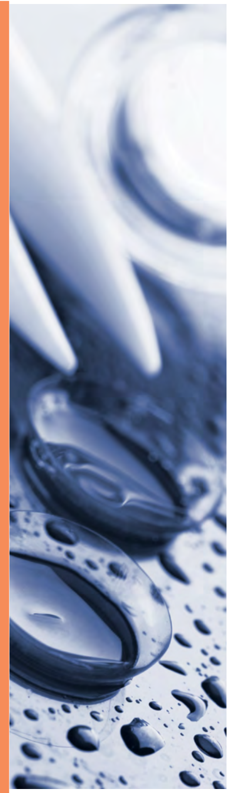
Solutions for
Biomaterials

Surface Characterization

Surface Characterization Methods for Biomaterials

	CHALLENGE	SOLUTION	YOUR BENEFITS
PROSTHESES, IMPLANTS, TISSUES, AND BIOPOLYMERS 	You want to investigate the behavior of implant materials under conditions that are as similar to the real conditions in the human skeletal system as possible.	**Measure friction**, **wear**, and the effect of **tribo-corrosion** with the highest possible resolution at a macroscopic scale in terms of **sliding velocity** and **frictional forces** with the **MCR tribometer**.	With a sliding velocity range of a few nm/s to an excess of 1 m/s with an extremely high resolution, you simulate the motion sequences in the human body more exactly than with any other tribometer. Combined with special sample holders for complex samples like soft tissues or cartilage, this will give you the in-depth insights you need for the development of high-performance biomedical materials.
	You need to know which effect a certain active substance has on the bone, e.g. when researching a new medication for osteoporosis.	Measure bone **hardness**, **elastic modulus**, and **creep** with the **bioindenter UNHT^3 Bio**.	Osteoporosis is the loss of bone hardness, so there is a direct correlation between the effect of medication and the bone hardness parameters. High-resolution analysis of those key parameters gives essential support to your research results when filing patents or promoting new active substances for testing processes or market launches.
	You want to optimize biocompatible surface coatings on implant materials.	Use **SurPASS 3** to measure the effect of **protein adsorption** on implant materials, which is the initial step of **cell adhesion**.	You can characterize the interaction of proteins in solution with implant materials. This will help you develop materials that prevent bacterial biofilm formation.
OPHTHALMIC APPLICATIONS 	The wearing comfort of a contact lens needs to be increased. Contact lenses are intended for use over an extended period of time and should be as good on the last day of use as they were on the first. But: Aging of materials is usually difficult to estimate.	Use the **bioindenter UNHT^3 Bio** to measure **elasticity** and the changes of **mechanical properties** due to aging. **Zeta potential analysis** with **SurPASS 3** will indicate changes in the **surface chemistry** of contact lenses due to wear.	With excellent resolution and research-oriented special features such as controlled force vs. depth measurements, you gain a deep understanding of your samples during research. You can then use the results to improve contact lens properties to serve your customers better in the future. Knowing the elasticity of a material provides a valid scientific insight into the aging process of contact lenses. Zeta potential analysis is suited to study biocompatible surface coatings and visualizes even the slightest changes in the chemistry of a surface.
	Ophthalmic solutions need to have low friction, and it is difficult to mimic human conditions on a machine. The need for testing these solutions arises from both economic and comfort aspects.	Use the **MCR tribometer** to measure the **friction coefficient** over a broad spectrum of sliding velocities and normal forces.	MCR tribometers are highly sensitive instruments. Their extreme low-speed capability allows characterization of both static and kinetic friction regimes. In most cases, the accurately determined boundary friction is critical in testing the overall performance of the fluid.
	Testing of hydrogels is complicated due to their soft nature and the difficulty of mounting them in/on a sample holder. During this process, minor changes in the pressures exerted on hydrogels could lead to a significant influence on their tribological properties.	Use the **MCR tribomete**r with specialized sample mounting options to test hydrogels accurately without any external influences.	Apart from special sample holders, MCR tribometers allow optimal adaption to real-life conditions in terms of contact pressure, sliding velocities, and temperature. They have a high sensitivity in terms of measuring friction over a range of sliding speeds from a few nm/s to 1 m/s, enabling you to simulate the frictional behavior of materials in contact as close to real-life operating conditions as possible.
	You want to test the water content of your contact lens, as its wearing comfort and shelf-life depend mainly on this parameter.	Measure the water content of your soft contact lenses by determining the **refractive index** with the **Abbemat refractometer**.	Measurements with the Abbemat refractometer series can be performed by pressing the contact lens to the measurement surface without any sample preparation. Abbemat refractometers from Anton Paar are fully compliant with 21 CFR Part 11 regulations.
	Newly developed and modified polymers need to be tested to see if they reach the desired optical properties of contact lenses or glasses for visual aids. Polymers with a higher refractive index allow for thinner lenses and glasses.	Measure the **refractive index** of your contact lenses' or glasses' material with the **Abbemat refractometer**.	Abbemat refractometers measure the refractive index within seconds. No sample preparation is necessary.
TEETH AND BIOFILMS 	You want to develop tooth enamel materials that prevent caries or allow minimally invasive treatments of early caries lesions.	Measure teeth enamel **hardness** with the **NHT^3 nanoindentation tester**.	Nanoindentation is one of the most adapted methods for samples as small as tooth enamel and provides a clear insight into the material's hardness gradient. The obtained analysis data is an essential basis for selecting new materials for use in dental repair.
MEDICAL DEVICES: STENTS 	Coatings for stents should adhere well to the substrate; stent quality is strictly regulated by medical authorities. However, there is no clear testing method available to check the coating quality.	Measure **adhesion** and **scratch resistance** with the **NST^3 scratch tester**.	Scratch testing is one of the few methods that can verify the adhesion of a coating and thereby ensure a sufficiently long lifetime of the implant.

Mechanical surface analysis

- Indentation testing from the micro to the nano range, including bioindentation with environmental control
- Scratch testing in the nano, micro, and macro (Revetest) range
- Combined indentation and scratch testing
- Abrasion testing

Several of these mechanical surface testers can be combined on one modular testing platform.

Parameters: elastic modulus | creep and viscoelastic properties | coating adhesion | scratch resistance

Tribological surface analysis

It is crucial to determine the tribological properties of biomaterials in measurements close to real conditions (liquid solutions included). The wear and friction properties of materials can be determined precisely with the range of tribometers offered by Anton Paar, from micro tribometers to the MCR tribometer.

Parameters: friction coefficient | wear resistance | lubrication

Optical surface analysis

The refractive index is the main parameter used for the optical analysis of biomaterials. Optical analysis provides quality information about your sample within seconds. Abbemat refractometers are the right tools for many applications, e.g., quality control of contact lens liquids. Get the refractive index of your materials and draw valuable conclusions.

Parameters: refractive index

Chemical surface analysis

Based on the surface zeta potential, chemical surface analysis gives you insights into modifications resulting from surface treatment and surface interactions with natural environments under near-ambient conditions. With SurPASS 3, Anton Paar offers an electrokinetic surface charge analyzer for fully automated zeta potential measurements and automatic pH scans.

Parameters: solid surface zeta potential | isoelectric point | liquid-on-solid surface adsorption kinetics

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