



Surface characterization methods for biomaterials

	CHALLENGE	SOLUTION	YOUR BENEFITS
 <p>PROSTHESES, IMPLANTS, TISSUES, AND BIOPOLYMERS</p>	<p>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.</p> <p>You need to know which effect a certain active substance has on the bone, e.g. when researching new medication for osteoporosis.</p> <p>You want to optimize biocompatible surface coatings on implant materials.</p>	<p>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.</p> <p>Measure bone hardness, elastic modulus, and creep with the bioindenter UNHT³ Bio.</p> <p>Use SurPASS 3 to measure the effect of protein adsorption on implant materials, which is the initial step of cell adhesion.</p>	<p>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 to develop high-performance biomedical materials.</p> <p>Osteoporosis is the loss of hardness of the bone, 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 launch.</p> <p>You can characterize the interaction of proteins in solution with implant materials. This will help you develop materials that prevent bacterial biofilm formation.</p>
 <p>OPHTHALMIC APPLICATIONS</p>	<p>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: the aging of materials is usually difficult to estimate.</p> <p>Ophthalmic solutions need to have low friction and it is difficult to mimic human conditions on a machine. The need to test these solutions arises from both an economic and a comfort aspect.</p> <p>Testing of hydrogels is complicated due to their soft nature and the difficulty of mounting them in/on a sample holder. Minor changes in the pressures exerted on them during this process could lead to a significant influence on their tribological properties.</p> <p>You want to test the water content of your contact lens, as its wearing comfort and shelf-life depend mainly on this parameter.</p> <p>It needs to be tested whether newly developed and modified polymers 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.</p>	<p>Measure the smallest friction coefficients with the NTR³ nano tribometer. Use the bioindenter UNHT³ Bio to measure elasticity and the change 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.</p> <p>Use the MCR tribometer to measure the friction coefficient over a broad spectrum of sliding velocities and normal forces.</p> <p>Use the MCR tribometer with specialized sample mounting options to test hydrogels accurately without any external influences.</p> <p>Measure the water content of your soft contact lenses by utilizing the refractive index with the Abbemat refractometer.</p> <p>Measure the refractive index of your contact lenses' or glasses' material at different wavelengths in the visible light spectrum with the Abbemat refractometer.</p>	<p>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.</p> <p>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.</p> <p>Apart from the 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.</p> <p>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.</p> <p>The Abbemat refractometers measure the refractive index within seconds. The Abbemat MW multi-wavelength refractometer enables refractive index measurements at different wavelengths within the visible range of light, e.g. for dispersion or Abbe number calculations. No sample preparation is necessary.</p>
 <p>TEETH AND BIOFILMS</p>	<p>You want to develop tooth enamel materials that prevent caries or allow minimally invasive treatment of early caries lesions.</p>	<p>Measure teeth enamel hardness with the NHT³ benchtop nanoindentation tester.</p>	<p>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.</p>
 <p>MEDICAL DEVICES: STENTS</p>	<p>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.</p>	<p>Measure adhesion and scratch resistance with the NST³ scratch tester.</p>	<p>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.</p>



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 the 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 the nano and micro tribometers to the MCR tribometer.

Parameters: Friction coefficient | Wear resistance | Lubrication



Optical surface analysis

The refractive index is the main parameter used for optical analysis of biomaterials. Optical analysis provides quality information about your sample within seconds. Abbemat refractometers are the right tools for entry-level quality control of contact lens liquids up to a multi-wavelength scan for dispersion determination as well as for determination of the Abbe number over the entire spectrum of visible light. Get the refractive index and the Abbe number of your materials and draw valuable conclusions.

Parameters: Refractive index | Abbe number



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 the 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

