ETA™

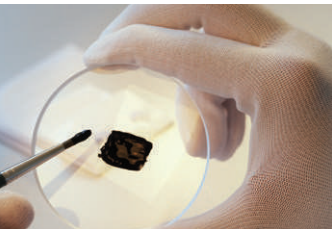
Non-Destructive Quality Assurance with Spectral Measurement of Coated Curved Surfaces

ETA-ARC-AT

Knowledge is your strongest tool

Comprehensive quality assurance is the key to high product quality. The challenge for manufacturers is to simultaneously ensure cost-effective production.

This is especially true in industries that utilize coatings, where variations in coating thickness or uniformity can lead to product quality failure. In the precision optics and eyewear/opthalmics industries, where unit costs are particularly high, the traditional method for testing coating quality has two further drawbacks:

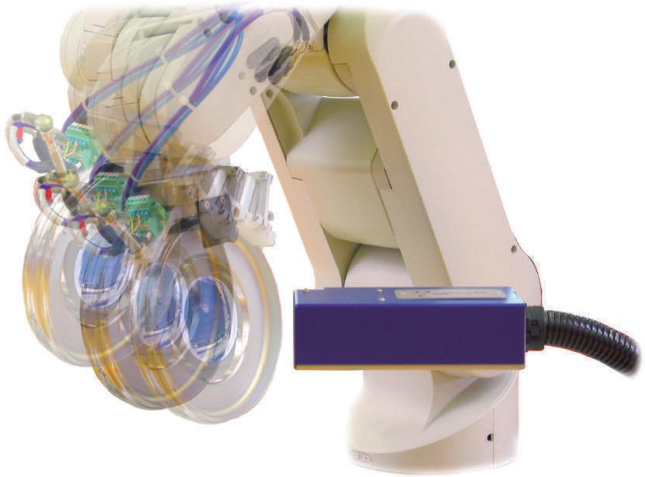


- In order to measure, it requires destruction of the tested sample, which is costly both from the labor standpoint as well as in terms of lost product sales,
- It provides only indirect, inferential quality control – the product sold is not actually measured, so complete quality assurance cannot be guaranteed.

Are reference pieces effective?

Another serious issue is the use of plano-parallel reference pieces in the coater to monitor the coating distribution. We believe that their purpose should be questioned, because of the following issues:

- When measuring the reference piece, no information about the actual lens or glass is obtained.
- Using reference pieces decreases coater capacity for actual product.
- The material of the reference piece must match the product's raw material. This can be very expensive, depending on the glass type used.
- The reference piece also needs to be roughened and blackened before measurement, adding more cost and time to the overall procedure.



Here an ETA-ARC-AT measures the coating of a lens in a fully automated OEM application.

Process control and quality, with non-destructive sampling

The only truly effective way to meet quality goals and achieve cost-effective production is to apply comprehensive non-destructive testing.

NXT offers a unique contactless measurement instrument that can quickly and accurately measures spectral reflectance and color appearance of anti-reflective (AR) coatings, or coating layer thickness of hard coatings and varnishes on transparent and translucent curved surfaces. The ETA-ARC-AT is the best tool for the job, because:

- It successfully suppresses rear-side surface reflection, which eliminates the need to roughen or blacken the sample. This means that tested products can also be sold.
- Fast measurement of spectral reflectance, and evaluation of layer thickness and colorimetric data, enables larger QA samplings to be made – 100% if so desired.
- Comprehensive measurement documentation supports traceability and repeatability, making continuous process improvement possible.

Dedicated to your quality and production efficiency

Our key technologies and components are developed and manufactured in-house by our team of skilled engineers.

Since 1991, we have designed, developed and manufactured spectrometric measurement solutions for industrial and laboratory applications. We provide comprehensive spectrometric quality assurance solutions to leading developers and manufacturers of precision glass products and other industries that prize accuracy, quality and cost-effective process control.

Our combination of excellent technical performance, close customer contact and a strong worldwide sales and service network makes NXT the best choice to boost your production efficiency with systematic testing that secures good results.

WHY SHOULD YOU USE THE ETA-ARC-AT?

- Cost reduction – no roughening and blackening, and no product waste from QC procedures
- Optimize use of coater capacity by reducing or eliminating reference pieces
- Contactless, non-destructive measurement on arbitrarily curved surfaces
- Complete check of coating homogeneity is possible
- 100% quality assurance is possible

Make ETA-ARC-AT work for you

The ETA-ARC-AT eliminates the problems associated with the measuring of anti-reflective coatings and protection varnishes on lenses as well as eyewear.

With the ETA-ARC-AT, the sensor head collects the light reflected at a transparent curved coated medium. Its special design allows reflectance measurements but suppresses the light reflected at the object's rear side. Thus, separate measurements on both sides of the object are possible.

Achieve continuous improvement in your production

The ETA-ARC-AT system consists of a spectrometer for the visible spectral range, a light source, and a unique proprietary sensing head. Light source and spectrometer are integrated in a desktop housing, and connected to the sensing head via optical fiber and electronics cables.

Integrated autofocus and tilt sensors respectively achieve the best possible photometric accuracy and repeatability, and ensure that reflected light always enters the detector aperture correctly, regardless of the curvature of the measured object.

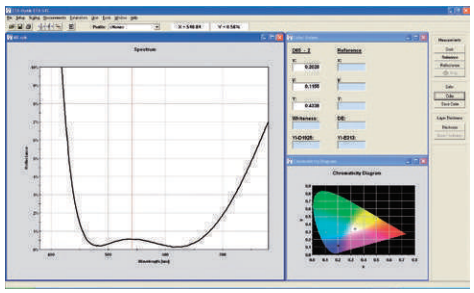
The result of nearly two decades of spectrometer development and testing, followed by use in high-precision production environments, the instrument carefully records the reflectance spectra. Interpretation is then performed by a sophisticated software, which includes tools for calibration, data acquisition, and data evaluation. All acquired and evaluated data can be stored for documentation or exported to other applications.

Eyewear/opthalmics

In the highly competitive eyewear market, quality assurance overheads can be a major portion of production costs – which affects both price competition and sales margins.

The ETA-ARC-AT system minimizes your quality assurance costs at the same time it gives you superior control over your coating process. You can achieve:

- Quality assurance of anti-reflective coating on the lens pre-form and finished product
- Thickness and uniformity testing of hard coating
- Reduce or eliminate the use of reference pieces



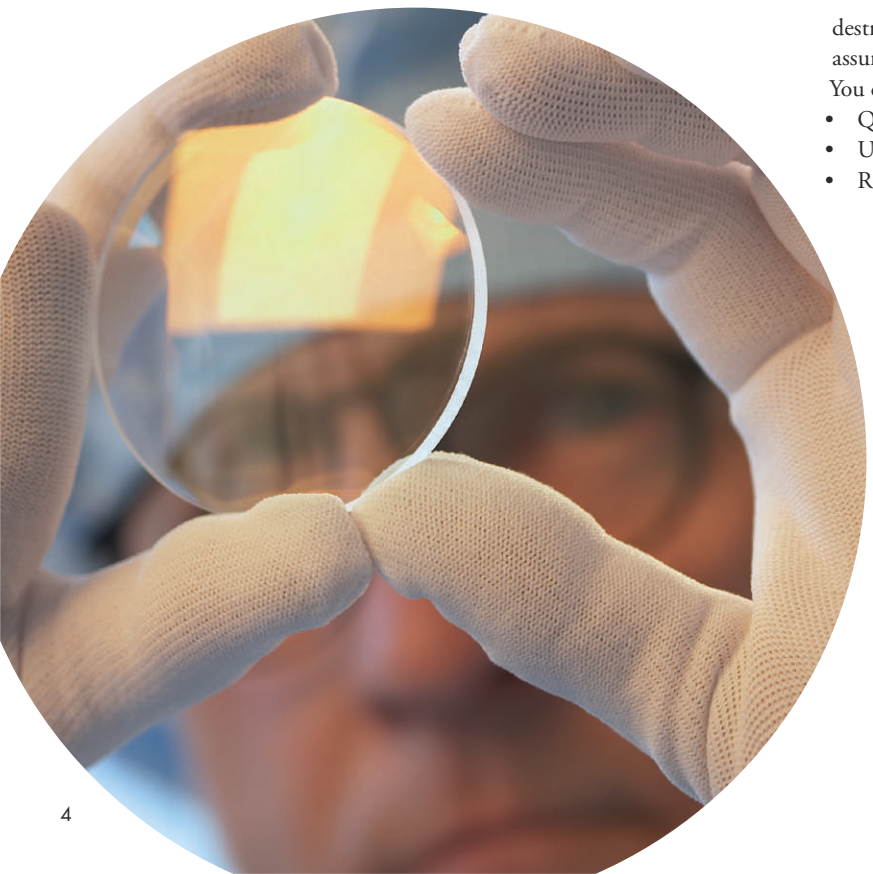
Spectral reflectance and color evaluation, as presented by the ETA-ARC-AT software package.

Precision optics

Comprehensive quality assurance should be a key competitive argument for precision optics manufacturers.

The ETA-ARC-AT system helps you achieve that goal with non-destructive testing while simultaneously reducing your coating quality assurance costs, even if you test up to 100% of your production. You can achieve:

- Quality assurance of anti-reflective coating on the actual lens
- Uniform color of AR coating, within and between batches
- Reduce or eliminate the use of reference pieces



Case study:

Quality assurance for precision optics

Fujifilm Recording Media GmbH fabricates high-quality polymer components exclusively according to customer specification, or in cooperation with project partners. Precision lenses are an example of its portfolio.

At Fujifilm, Mr. Uwe Kleiwegen is responsible for product design, and for maintaining high and uniform product quality.

The situation

Characterization of the precision lens's anti-reflective (AR) coating is an important QA step at Fujifilm Recording Media GmbH.

Previously, quality control of the AR coating required destructive testing and inferential evaluation. In short, a lens's rear surface was roughened and blackened, to eliminate reflection from it, before measurement of the front surface could be made. The actual delivered lens was not tested, and the lens that was tested could not be sold.

The high cost of quality control using this method also negatively affected revenue targets.

Capabilities needed

Mr. Kleinwegen needed a technology that would test all produced lenses in a non-destructive way, in order to guarantee that each lens meets the tight customer specifications. At the same time, he needed a way to dramatically reduce the cost of Quality Assurance.

Capabilities provided

NXT provided Fujifilm Recording Media GmbH with a non-destructive measurement device that accurately characterizes the AR coating on curved surfaces. The need for destructive sample preparation is eliminated, and 100% Quality Assurance is made possible.

The result

Mr. Kleinwegen can now guarantee maximum customer satisfaction, as each lens delivered is measured and verified to meet the customer's specifications. Furthermore, the cost of Quality Assurance is greatly reduced and all tested lenses that are classified as good can be sold.

Assure your quality. Enhance your insight. Reduce your cost.

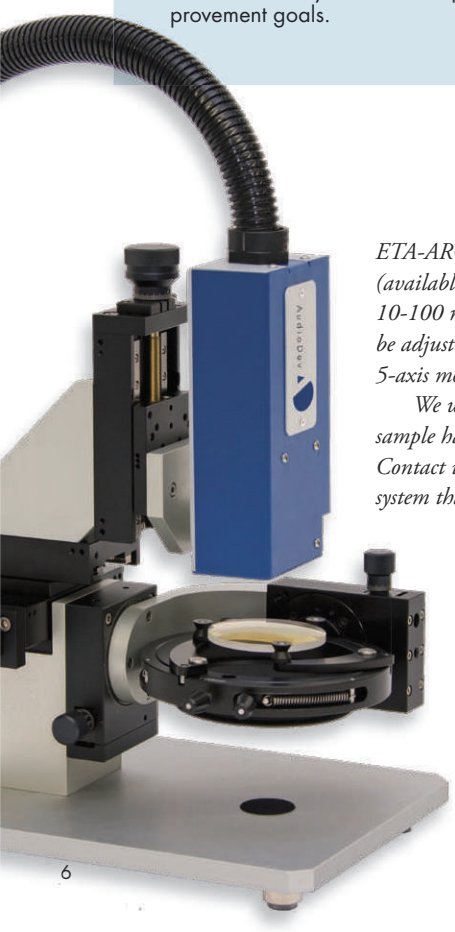
Quality assurance is never an investment to consider lightly.

When unit product values are high, and your quality reputation is at stake, it is critical to consider each factor involved – not least product waste, labor costs, sample preparation expense, and production shortfall. The daily costs are high, and the cumulative costs can be enormous.

When it comes to assuring the quality and homogeneity of coatings, the ETA-ARC-AT system offers you a much better alternative. With no consumables costs, no product destruction and the possibility to achieve quick in-line inspection that raises your overall coating quality, you will quickly recover its purchase cost.

CAPABILITIES & ADVANTAGES

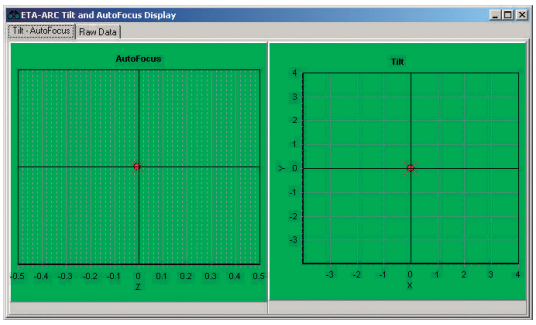
- Measure each product in a non-destructive way. No waste or discard of expensive tested product. If desired, you can achieve 100% coating inspection of sold products.
- With no roughening or blackening of samples, you reduce material waste and labor expense.
- No reference glass is needed for coating verification, thereby increasing your coater capacity.
- No risk of product damage during treatment, thanks to contactless measurement.
- Achieve perfect color matching from product to product, and between different production batches.
- Accurate measurement of coating homogeneity, and testing of color and reflection properties on curved surfaces.
- Ensure traceability in production. Use software to get the documentation you need to support your continuous improvement goals.



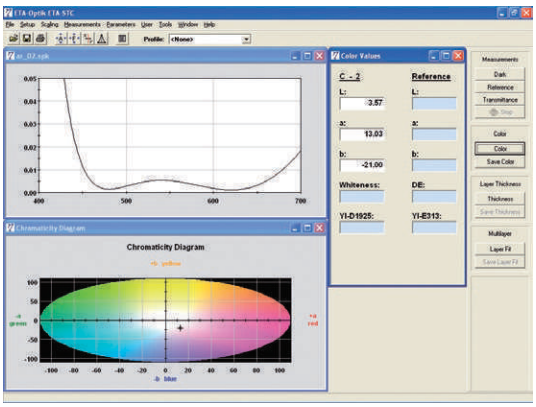
ETA-ARC-AT fitted to a sample table (available as accessory), holding lenses with 10-100 mm diameter. Sample position can be adjusted precisely with an independent 5-axis movement system.

We will soon release a fully automated sample handling and positioning system. Contact us to discuss the sample handling system that best matches your needs.

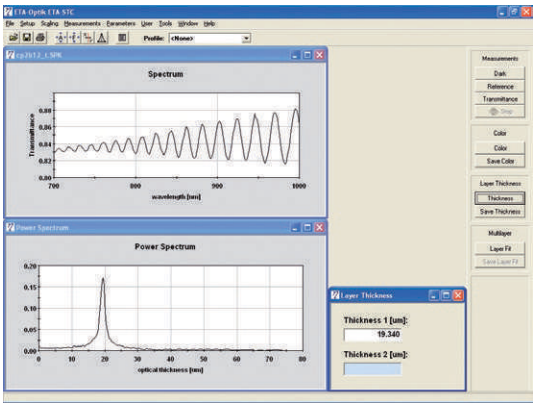
Software



The focus and tilt software tool guarantees accurate sample positioning, thus ensuring photometrically correct measurement on arbitrarily curved surfaces.



Spectral reflectance and color appearance of a broadband AR coating. Color space is user-definable, with results expressed in e.g. CIE-Lab and CIE-xyY. A cursor tool allows a simple and direct readout of the rest reflection for a chosen wavelength.



Measurement of hard coating layer thickness. The interferogram is proportional to the coating thickness and is evaluated quickly and accurately by the software.

System Specifications ETA-ARC-AT

MEASUREMENT	**380-780**	**380-1050**
Typical applications	Reflection of AR coating	Reflection of AR coating / thickness of hard coating
Photometric accuracy	0.5% in respect to reference sample	0.5% in respect to reference sample
Thickness range*	0.5-25 µm	0.5-20 µm
Thickness accuracy	± 0.05µm	± 0.05µm
Thickness repeatability	3σ < 0.005µm	3σ < 0.005µm
Chromaticity accuracy	x,y ± 0.002 Y ± 0.5	x,y ± 0.002 Y ± 0.5
Chromaticity repeatability	x,y 3σ < 0.001 Y 3σ < 0.1	x,y 3σ < 0.001 Y 3σ < 0.1

SPECTROMETER	**380-780**	**380-1050**
Detector	High linear Si line sensor	High linear Si line sensor
Number of pixels	512	512
Wavelength range	380-780 nm	380-1050 nm
Theoretical resolution	0.8 nm	1.3 nm
Optical resolution	3.1 nm	5.2 nm
Wavelength accuracy	± 0.5 nm	± 0.5 nm
Digitalisation	16-bit	16-bit
Scan time	> 6 ms	> 6 ms
Typical measurement time	~ 50-100 ms	~ 50-100 ms
Fiber connection	SMA 905	SMA 905
Communication	USB / Ethernet	

LIGHT SOURCE	
Illumination type	Halogen light
Wavelength	Polychromatic / 3000 K color temperature
Lifetime	> 2.000 hours
Shutter	Dark measurement via dark wedge or shutter

SPECTROMETER HOUSING	
Housing Dimensions (W x D x H)	471 x 317 x 166 mm ± 1 mm
Power supply	100-240 V AC / 50-60 Hz (auto range)

FIBER OPTIC CABLES	
Type	Mono-fiber
Core diameter	100µm detector / 200µm illumination
Length	3m
Cover	Premium Grade stainless steel tubing
Fiber connection	SMA 905
Short term bending radius	> 100 mm
Long term bending radius	> 200 mm

ETA-ARC-AT MEASURING HEAD	
Dimensions (W x D x H)	200 x 80 x 50 mm ± 0.5 mm
Working distance	52 mm (nominal)
Measurement aperture	< 8°
Detection range of Tilt sensor	± 2°
Detection range of Focus sensor	± 7mm
Rear face reflection suppression	100% suppression for glass thickness > 2mm

SOFTWARE	
Measurement functions	Spectral reflectance / thickness measurement / color measurement / tilt and focus detection
PC requirements	Windows® 7 / 8 / 10, 8 GB RAM, >500 GB HDD, USB or Ethernet port

*using FFT method. Curve Fit method allow thinner layers to be measured

This is NXT GmbH

NXT is a world leader in comprehensive quality assurance solutions for specialized industries. We offer high-precision analyzers, proactive customer support and training, and Test-Centers around the world.

For different industries, our ETA™, Helios and Xelas instrument families are perfect tools for protecting quality and production efficiency. With a large installed base of testers worldwide, NXT has achieved recognition as a perfect and reliable partner for optical measurements solutions.

For producers of solar cells, OLEDs, optical medias, flat panel displays, precision optics, automotive glass, consumer packaging and other thin film applications, our solutions provide comprehensive, non-destructive quality assurance that is both time- and cost-efficient.

Our headquarter is located in Heinsberg, Germany, with subsidiaries in Sweden, USA, China and Taiwan, plus a service and support network of agents worldwide. In 2016 NXT GmbH was renamed from the formerly well known AudioDev GmbH, also known as ETA-Optik GmbH before 2007.

NXT

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