Custom Metrology Solutions

k-Space Associates, Inc.

k-space.com

Your Industrial Metrology Partner

Putting Light to Work
Since 1992

Custom non-contact measurements and software integration for production environments.

Measure and control for uniformity, dimensions, surface characteristics, breakages, defects, and more.

Take your production to the next level!

Contact k-Space today
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What's your measurement challenge?

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Custom Glass Inspection Solutions

- A custom solution that measures your specific needs for glass inspection
- Improve yield, reduce costs, increase customer satisfaction, and grow production

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Glass Inspection & Quality Control

Take Your Production to the Next Level

The glass industry has its own unique set of requirements that k-Space's glass metrology can accommodate. There are needs for edge inspection, broken glass detection, glass thickness measurement, film thickness measurement, spectral reflectance, absorption, transmission, and color (L*a*b*) measurement, to name a few. Using state-of-the-art spectrometers, light sources, machine vision technology, and other tools, our product engineers, software engineers, and physicists can develop a solution that measures your specific needs for glass inspection. This leads to better quality control, which in turn leads to happier customers, and improved yield. Bring your glass measurement challenge to us, and we will engineer a custom inline or ex situ metrology solution for you.

Solar Panel Inspection

- Measure for breakages and defects, panel thickness and flatness, coatings, surface roughness, and much more
- Our custom solar panel metrology tools are compatible for large and small glass sizes and throughputs

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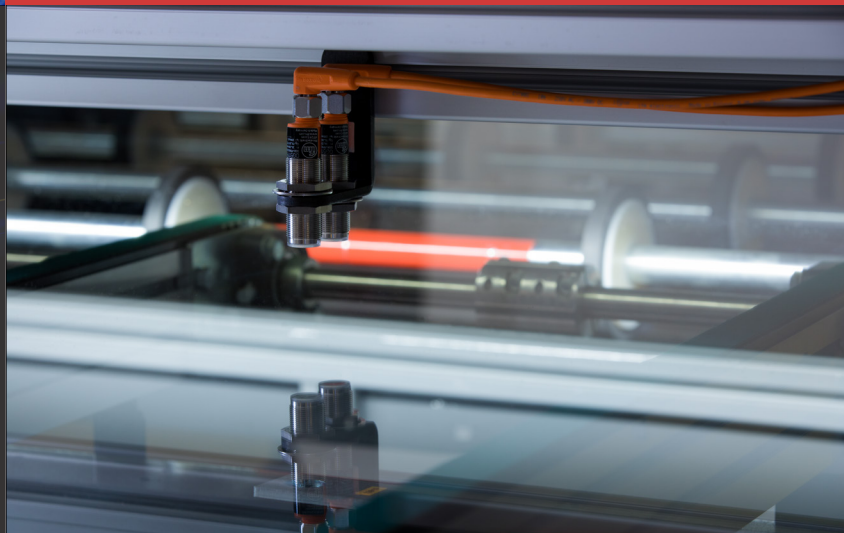

Solar Panel Inspection

Custom solar panel metrology that takes your production to the next level

The solar industry is hyper-competitive and with that comes the need for solar panel manufacturers to continuously improve their processes and products. At k-Space, we have the proven ability to measure various parameters on frame components, bare glass, coated glass, and fully assembled panels, as well as edge profile inspection, barcode placement, and more. We employ a wide range of spectroscopic techniques, LED lights, sensors, cameras, machine learning tools, and software to deliver the results you need.

Our custom metrology tools can detect chips, cracks, contaminants, and panel dimensions. Measure and control uniformity, thickness, band gap, temperature, surface roughness, and other factors. Gain competitive insight and take your production to the next level! Send us your samples. We will show you the data and guide you on how best to solve your measurement challenges.

Glass Breakage & Defect Detection

- Real-time visual and data analysis of glass breakage and defects
- Reduces downtime and lowers scrap costs
- In-process QC validation ensures all panels conform to your standard

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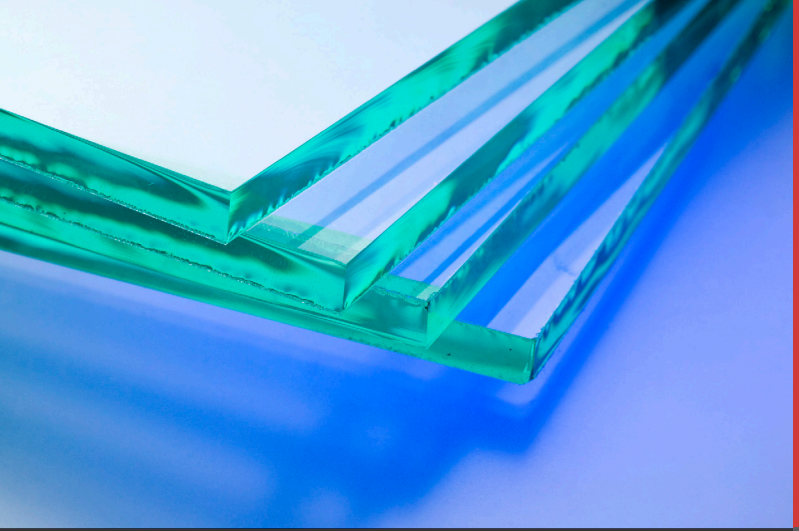
Glass Breakage & Defect Detection

A vision-based metrology tool that inspects and determines Go/No-Go for every glass lite and panel

Our Glass Breakage & Defect Detection tool is a vision-based metrology system that determines Go/No-Go (Pass/Fail) conditions for every glass lite and panel it inspects inline during processing. This is achieved by comparing coated or uncoated glass lites and panels against your defined parameters and tolerances in a master specification recipe. Identify defects such as cracks, chips, scratches, digs, and pinholes that are outside your master spec. The custom frame enclosure houses high resolution linescan cameras, LED lights, and photoeyes. Acquisition is encoder triggered. The control unit provides image processing and data storage. Quickly quarantine or scrap inline defective product as it moves along the line. Documented compliance with applicable glass visual and safety standards (ASTM, ANSI) ensures consistency across all glass lites and panels.



Panel Edge Inspection

- Measures the edge profile of a glass lite or panel
- Detects chips, cracks, debris, dual pane offset, and shiners on the production line

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Panel Edge Inspection

Measure the edge profile of a glass lite or panel as it travels through the process line

A non-contact, inline glass metrology tool that measures the edge profile of a glass lite or panel. Inspects lites and panels to rapidly detect non-compliant edge defects (chips, digs, cracks, and debris) based on preset limits.

The k-Space Panel Edge Profile tool utilizes a 405nm laser line to measure the edge profile of a glass lite or panel as it travels through the process line, measuring grind radius, dual pane offset, edge squeeze, and more and comparing to preset tolerances.

This tool can detect chips, cracks, debris, dual pane offset, and shiners on the production line, for real-time quality control. Inline identification of edge defects (chips, shiners, etc.) reduces the chance of downstream glass breakage and yield losses.

Absolute Spectral Reflectance

- Measures color information (L*a*b* parameters)
- Can determine film thickness
- To characterize various films, including anti-reflection coatings (ARC)

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Absolute Spectral Reflectance

Measure absolute spectral reflectance to characterize various films, including anti-reflection coatings (ARC)

The k-Space Absolute Spectral Reflectance tool measures absolute spectral reflectance to characterize various films, including anti-reflection coatings (ARC). The system utilizes a custom 340-930nm spectrometer. An internal quartz reference continuously calibrates the absolute reflectance between panels. The tool measures color information (L*a*b* parameters) and scales the values to the sun light output distribution function. The tool detects panels through a threshold signal level (peak intensity of raw spectrometer signal). The optional kSA FitTool™ simulation and fitting software adds the ability to determine film stack thickness.

Panel Thickness and Flatness

- Measure overall panel warp, waviness, and bow
- Ensures documented compliance with applicable thickness and bow/warp standards

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Panel Thickness and Flatness

Measure total glass thickness, flatness, and total thickness variation (TTV)

Our Glass Thickness and Flatness Tool is an in-line, non-contact metrology tool that measures total glass thickness, flatness (bow, warp, etc.), and total thickness variation (TTV). The tool utilizes 10 laser-based height sensors (5 above and 5 below) to measure 5 positions along the width of the glass panel.

The software deduces bow, warp, and TTV measurements from the individual height measurements, and derives the glass thickness from the measured surface heights after the system is calibrated to known thickness standards. Scans clear or coated single glass lites or multiple glass panel assemblies with interlayers (glass offset) of thicknesses ranging from 2 to 12 mm. Measures panel thickness with +/- 5 µm accuracy.

X-Ray Fluorescence

- Measures dielectric coatings that are too thin for optical measurements
- Immediate detection of defects in the coating thickness
- Identifies the spectral peaks of the X-ray emission spectrum and collects the peak intensities for further processing

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X-Ray Fluorescence

Measures the layer thickness of film on glass and solar panels that are too thin for reliable optical measurements

The innovative kSA XRF (X-Ray Fluorescence) metrology tool measures the layer composition of films on glass and solar panels that are too thin or too absorbing for standard semi-transparent optical measurements. It uses an X-ray source, detector, and sophisticated software to measure the X-ray emission spectrum to calculate film composition. This tool can be integrated into existing QC systems, along with the appropriate alarms, to flag composition variation. The tool bridges over conveyor lines for easy installation and future factory access to the conveyor line. Photo eyes detect the leading and trailing edges of the panels to trigger the system to start and stop data collection, and proper safety measures are taken to ensure radiation does not leave the XRF enclosure.

Barcode Inspection

- Confirms the number, location, and dimensions of laser-etched barcodes on each panel before coating, ensuring better product quality and reducing stoppages
- Includes the ability to reconstruct and read skewed or defective barcodes, including in high production environments

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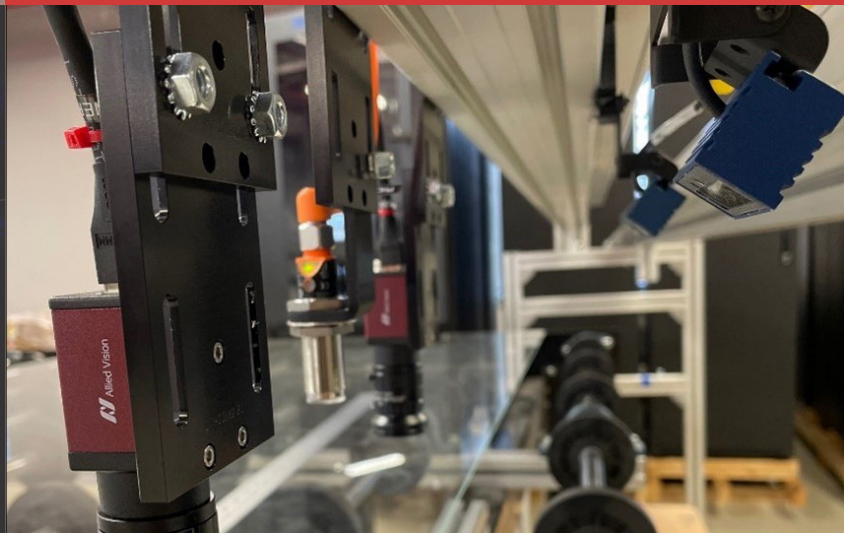

Barcode Inspection Tools

Confirm the barcode number, location, and dimensions stamped on each panel before coating

Confirm the barcode value, OCR, location, and dimensions on each panel before coating. Can even reconstruct bad or misaligned barcodes.

Our barcode inspection tool checks matching between barcode and OCR, and shows running statistics on barcode matching, dimensions, and location. If a barcode is stamped out of position, the operator is alerted immediately. Get detailed measurement and timing information on every panel.

The customizable software lets the operator easily mark dimensional tolerances and image calibration settings. Easy to setup and designed to work with virtually any glass or solar panel size or type.

Inline Sheet Resistance

- Monitor the thin film sheet resistivity on glass panels that pass through the system
- Ideal for flat panel display, solar, and other coated glass applications

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Inline Sheet Resistance

Immediate analysis of sheet resistance conductivity of thin-film coated panels

The kSA Inline Sheet Resistance Metrology system monitors the thin film sheet resistance on glass panels that pass through the system. Sheet resistance (also known as surface resistance) is a common electrical property used to characterize thin films of conducting and semiconducting materials to determine end product performance. The system consists of multiple pairs of sensor probes that are mounted on a frame that crosses over the conveyor. It is Ideal for flat panel display, solar, and other coated glass applications. Detects drift in conductive coating thickness across and potential impacts to end product performance. Inspects lites and panels to quickly identify non-compliant coated glass sheet resistance and conductivity values, based on preset limits. Fully customizable system (hardware/software) enables users to configure settings to fit their specific needs.

Custom Metrology Solutions

- Customizable, in-line inspection solutions with full factory integration
- Start-to-finish collaboration on a non-contact metrology solution
- Send us your samples for testing to get started

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Custom Metrology Solutions

Custom metrology tools and software for analysis and quality control of your manufacturing processes

Bring your measurement challenge to us. We will engineer a custom metrology solution for you. At k-Space we use non-contact, non-intrusive measurement techniques that are based on the most up-to-date optical technology. This includes state-of-the-art lasers, LEDs, broadband light sources, spectrometers, machine vision technology, software and other tools. Our product engineers, software engineers, and physicists will develop a solution for your specific measurement requirements. k-Space has over 30 years of experience helping companies monitor their production process for quality control and yield improvement. We look forward to working with you to implement the right metrology solution for your process.

Factory Integration

- Full factory integration includes customizable software tools
- Go/No-Go data in real-time
- Integrate with your production environment and digital systems

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Factory Integration

Because you need a custom metrology solution that solves your measurement challenges and integrates with your existing systems

You want a tool that solves your process problem and integrates with your existing systems. We work with you every step of the way to deliver the solution you need so you can achieve the production results you demand. k-Space's team of engineers is skilled at factory integration and can design the software to communicate with your existing factory control systems. We are skilled in SQL database generation and integration, real-time data acquisition and analysis, go/no go determination with alarm status, PLC communication and integration, light tower and HMI integration, bar code reading capabilities, photo-eye and encoder triggering, and more.

Your Metrology Partner

- We are experts in custom, fully integrated metrology solutions
- k-Space holds multiple metrology patents
- Over 30 years of putting light to work

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Your Metrology Partner

Putting Light to Work for Over 30 Years

k-Space is your proven metrology partner. Our solutions are used at over 1,000 customer sites in over 40 countries. We enjoy working with our customers thru the entire process, from concept, to specification, to implementation, to factory acceptance testing, to full support. We develop custom metrology innovations for the solar and glass industries, automotive, battery, building materials, and for the semiconductor and thin-film industries. We look forward to working with you!

Ask an engineer about your measurement needs today.

Send us samples of your product to test. We can provide full data analysis and guidance.

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