PRODUCT BROCHURE

Keysight REFLET 180S Bench 3D (Hemispheric) Scatterometer

For 2D / 3D scattered light measurements

KEYSIGHT

Introduction

Keysight REFLET 180S is a compact and motorized optical system for scattering characterization of any kind of materials and objects. It allows you to measure, in a fast and easy way, luminous energy distribution or spectral composition contained in the scattering lobes. Consequently, it characterizes surfaces of your examined regions such as roughness, defects as well as types of coatings or paintings… Moreover, the system measures bidirectional reflectance distribution function (BRDF) / bidirectional texture distribution function (BTDF) which perfectly represents the way any surface scatters incoming light in 3D space.

Applications

- Photorealistic rendering: accurate measurement of spectral behavior
- Optical sensors: medical, industrial, quality control, automotive
- Reflector material characterization for luminaries design
- Reflector material characterization for automotive headlamps design
- Cosmetics characteristics: spectral and specular behavior
- Roughness controls in production
- Quality control of dust/particles in semiconductor
- Liquid crystal display (LCD) backlighting
- Scattering of transmitting glasses
- Aerospace applications, measurements of black paints, BRDF of mirrors

Figure 1. Keysight REFLET 180S

Figure 2. Keysight REFLET 180S

Figure 3. Complete system delivered in a dark box (non-contractual photography)

Diffuser

The measurements are done in reflection and in transmission. Knowledge of the way light is reflected and transmitted through a diffuser is very important for the use of materials in optical systems.

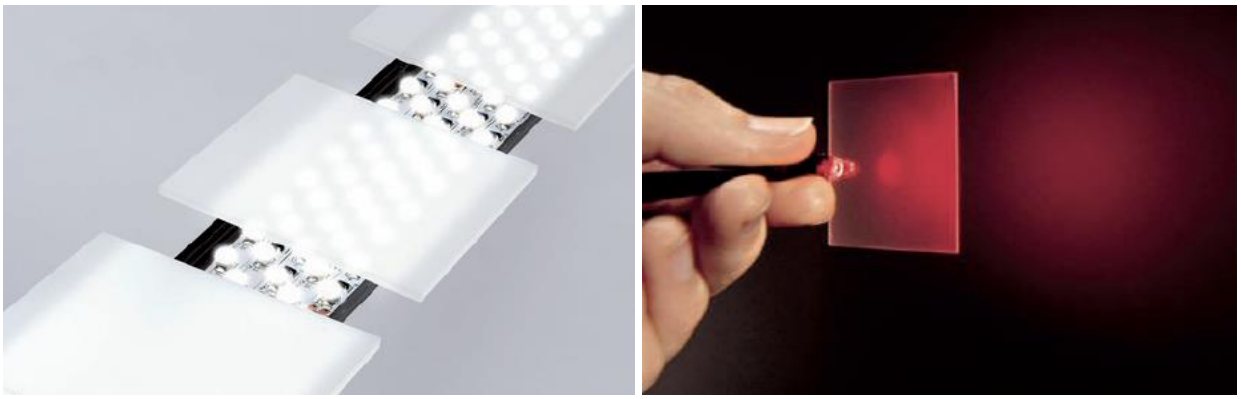

Figure 4. Light reflected and transmitted through a diffuser

Aluminum

Reflector materials can have quite complex behaviors depending on the plane of incidence. Keysight REFLET allows accurate measurements in different planes of incidence (examples: anisotropic material, polarization dependence...).

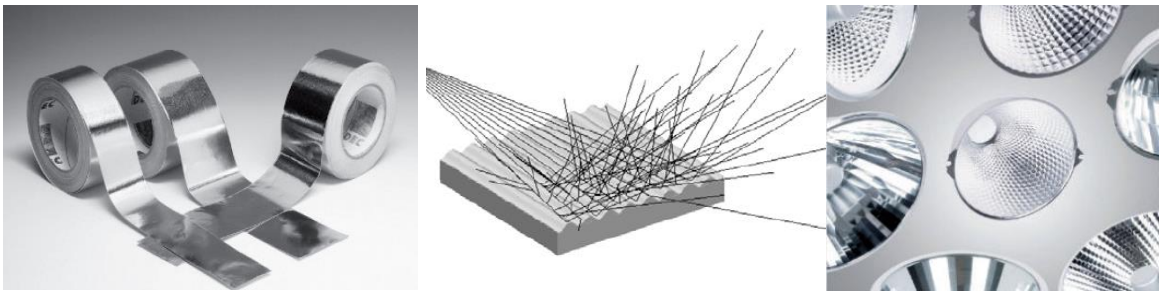

Figure 5. Aluminum samples and reflecting samples with anisotropic behavior

Polished optics

Specular surfaces (mirrors), transparent surfaces (glasses, lenses, crystals) have sometimes a very low scattering such as 10-9 sr -1. Those surfaces are very difficult to measure without a high dynamic detection system. Keysight REFLET has one which allows measuring BRDF of 10-5 sr -1.

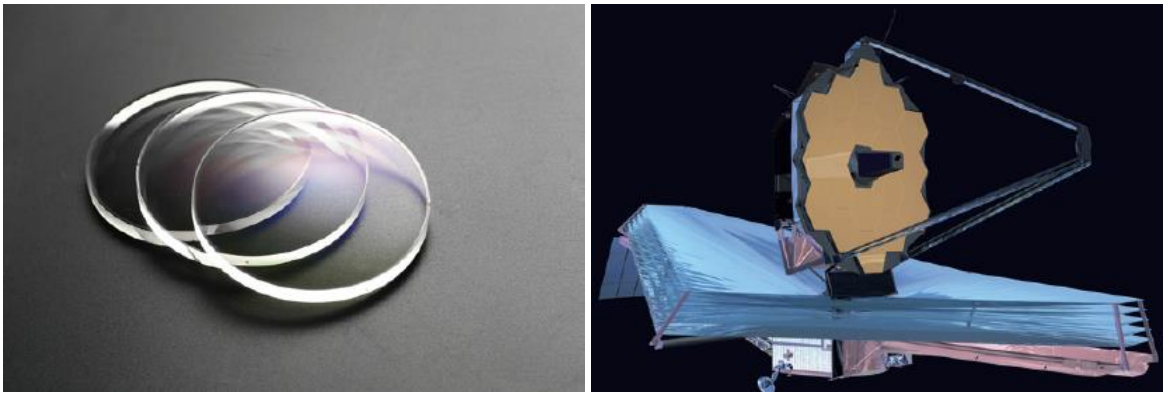

Figure 6. Highly polished transparent surfaces, low scattering coating, and specular mirror for the space industry

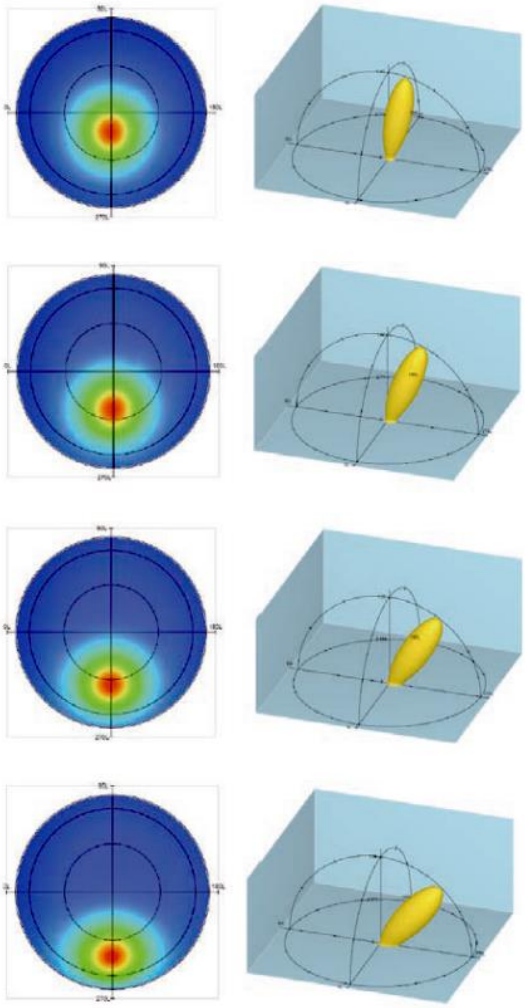

Figure 7. 3D scans

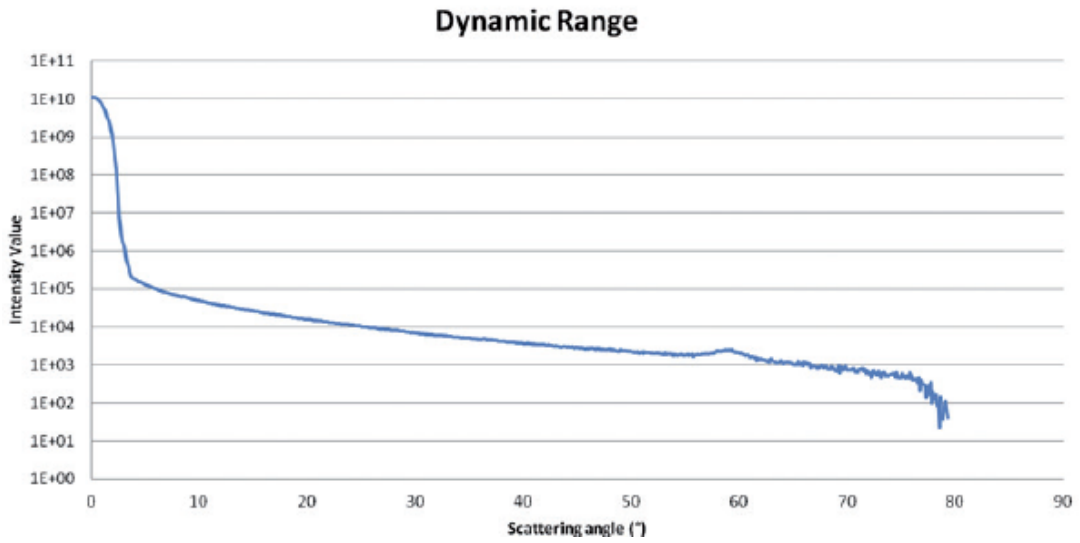

Figure 8. Dynamic range

Cosmetics

Cosmetic manufacturers need to compare different chemical mixtures to produce lipsticks or creams. Keysight REFLET allows the characterization of these types of products on different skins and under different lighting (different spectra).

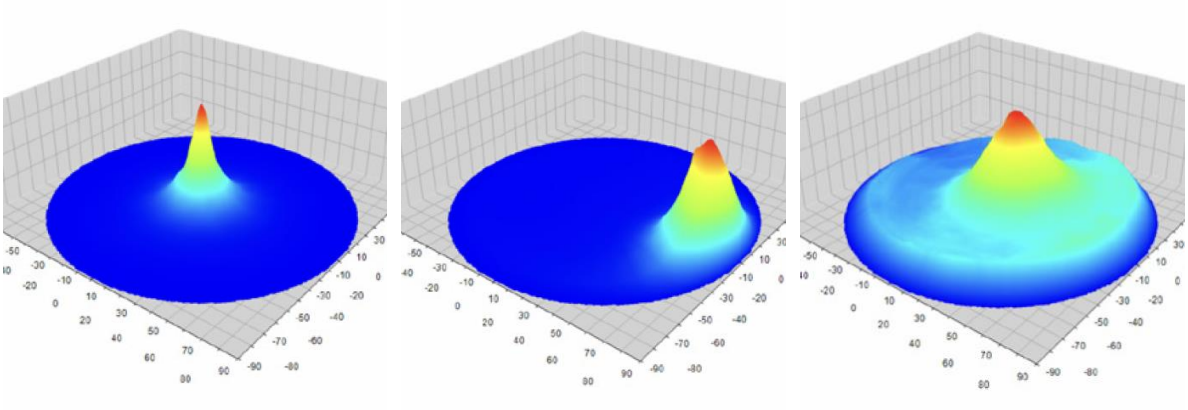

Figure 9. Examples of Keysight REFLET 180S measurements of cosmetics materials

Black materials

Mainly used in aerospace applications, black materials and coatings are also difficult to measure without a powerful instrument. Those materials need to have a very low BRDF because they absorb a big amount of light: less than 1% of reflection. Keysight REFLET supports such BSDF levels thanks to its high dynamic detection.

Figure 10. Examples of ultra dark, low reflective surfaces and materials for stray light reduction

Illumination design software

Illumination design software requires accurate data to provide accurate simulations. Keysight REFLET provides 2D/3D BRDF or BTDF files which can be imported in TracePro, ASAP, LightTools, LucidShape, Photopia, or Speos.

Figure 11. Examples of optical simulations with scattering measurements

Realistic rendering software

In many industries including automotive, optical designers need to simulate the closest to reality in order to provide realistic rendering. Today, our Keysight REFLET Bench allows you to perform the light characterization of headlamps, tail lamps, and dashboards. It will also provide you with scattering measurement data to import into your optical design software.

Figure 12. Scattering measurements in automotive applications using Keysight optical design software (headlamps, taillamps, dashboard, etc.)

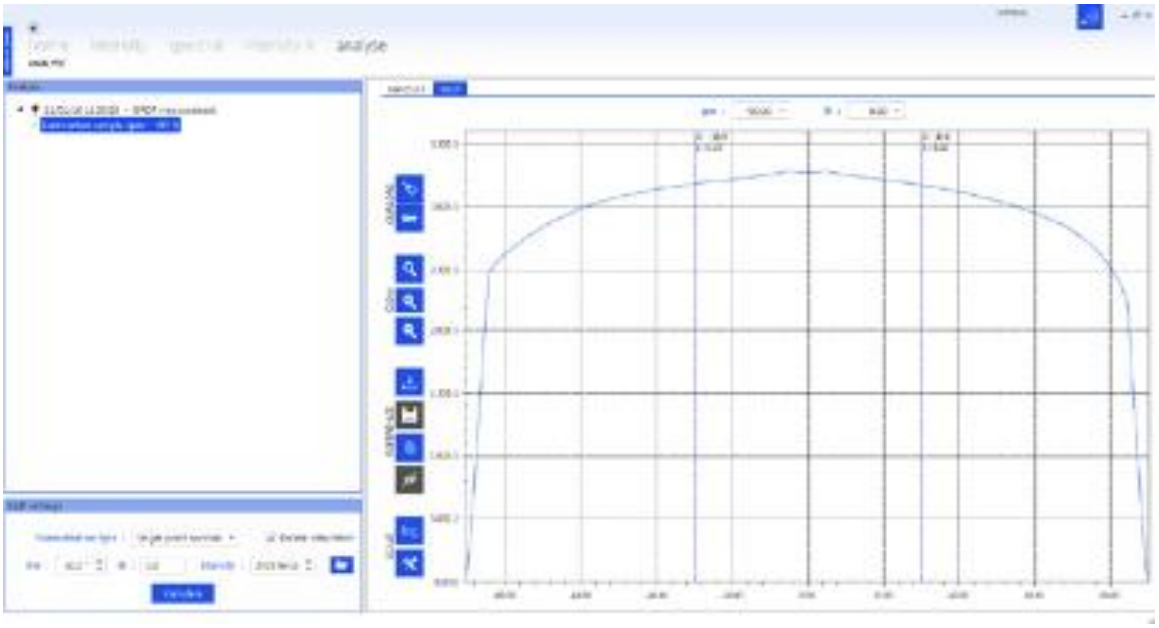

Figure 13. Keysight REFLET software

Technical specifications

Illumination	
Light Box	• Halogen 100W light box • Option: 6-position filter wheel (including R/G/B filters)
Spot size on the sample surface	Scattering configuration: Manually adjustable from Ø1 mm to Ø13 mm
Beam aperture angle	Scattering configuration: Manually adjustable from ±0.15° to ±2.26°
Goniometer	Standard version: • 0°-180° motorized (reflection and transmission) • Angular resolution: selectable (0.01°/0.1°/1°/10°) • Positioning precision: 0.01°
Detection	
Integrated-flux detector	• Visible channel: 400 - 1000 nm, dynamic 109 • Infrared channel: 900 -1700 nm, dynamic 106 (option)
Spectrograph (option)	• Useful range: 420 - 900 nm • Spectral resolution: selectable (0.6 nm/1 nm/5 nm/10 nm)
Optical system	Scattering configuration: 3 manually interchangeable optical blocs (2 to be chosen) Optical bloc 1 2 3 Angular acceptance ± 2° ± 1.1° ± 0.04° Observed area size Ø14mm Ø8mm Ø6mm
Goniometer	• θ: - 90° to 90° motorized • φ: - 90° to 90° motorized • Angular resolution: selectable (0.01°/0.1°/1°/10°) • Positioning precision: 0.01°
Polarizer/Analyzer set (option)	• Rapid insertion • 0°- 90° manual rotation
Measuring Time	
180° — profile (option)	• “Integrated flux” mode: 45 s • “Spectrograph” mode: 45 s
Software	
Exportation	• Text file (ASTM) • BSDF format (imported in commercial software)

Technical specifications (continued)

Measuring Time	
180° — profile (option)	• “Integrated flux” mode: 45 s • “Spectrograph” mode: 45 s
Software	
Exportation	• Text file (ASTM) • BSDF format (imported in commercial software)

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