

Polymer-Based Rubber Inspection

Terahertz NDT for Non-Contact Rubber Thickness, Bond Integrity and Quality Control

Polymer-based rubber materials such as **EPDM**, **silicone rubber**, **NBR**, **FKM**, **neoprene** and **polyurethane elastomers** are used in aerospace structures for **sealing, vibration isolation, thermal protection and interface management**. Thickness variation, air gaps and bonding discontinuities can affect component fit, assembly quality and service reliability.

TeraNIM-Aero helps inspect **polymer-based rubber non-destructively and without physical contact**, enabling aerospace teams to measure **rubber thickness, thickness uniformity and bonded-interface condition** using single-sided THz inspection without cutting or deforming the component.



Why Polymer-Based Rubber Needs Non-Contact Inspection?

- Soft rubber can deform during contact thickness measurement
- Thickness can vary across bonded or curved components
- Air gaps and interface discontinuities can remain hidden
- Installed components may provide access from only one side
- Repeatable digital measurement is needed for production quality control

Conventional Polymer-Based Rubber Inspection Challenges

- **Micrometer / Caliper**
- **Contact-Based Measurement**
- **Ultrasonic Testing**
- **Contact / Couplant-Based Inspection**
- **Polymer-Based Rubber**

Inspection Challenge

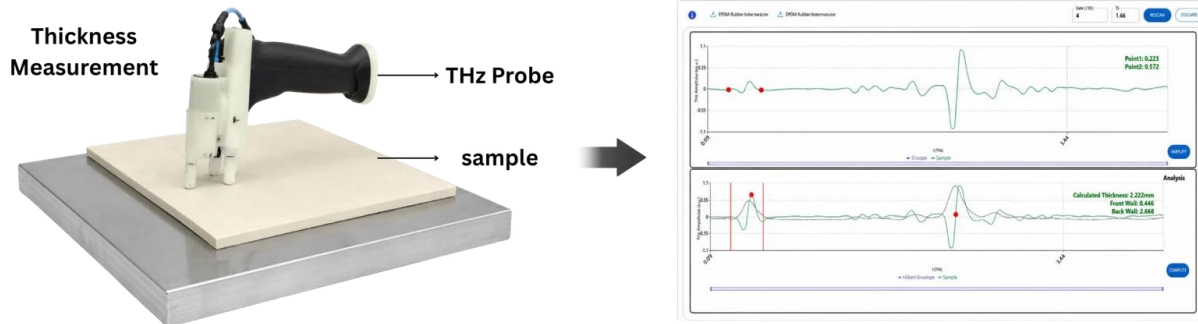
- ⚠ Soft and deformable material
- ⚠ Thickness variation
- ⚠ Bonded or curved structures
- ⚠ Hidden air gaps / interface anomalies
- ⚠ Need for single-sided non-contact measurement

How Terahertz Technology Works for Polymer-Based Rubber Inspection

TeraNIM-Aero directs a short THz pulse onto the rubber component and analyses reflections generated from the front surface and internal material interfaces.

A simplified inspection path is:

Air → Rubber Surface → Polymer-Based Rubber Layer → Bond / Back Interface → Substrate



TeraNIM Polymer-Based Rubber Inspection Workflow

SCAN

Direct a THz pulse onto the **polymer-based rubber surface** and acquire the reflected waveform using **single-sided, non-contact access**.

DETECT

Identify the **front-wall and back-wall/interface reflections** and monitor changes associated with thickness or bonding discontinuities.

ANALYSE & REPORT

Convert the reflected-signal time delay into **rubber thickness and thickness variation**, then store the waveform, measurement settings and inspection result.

Key Advantages for Aerospace OEMs & Research Organisations

- **Non-Contact Inspection:** Measure rubber components without applying physical probe pressure.
- **Non-Destructive Testing:** Inspect bonded or installed rubber without cutting or sectioning the component.
- **Single-Sided Measurement:** Useful where the opposite side of the rubber layer cannot be accessed with a micrometer.
- **Thickness Measurement:** THz time-of-flight information can provide calibrated polymer-based rubber thickness.
- **Traceable Digital Results:** Waveforms, echo positions, settings and calculated thickness values can be stored for quality records.
- **Automation Ready:** TeraNIM-Aero can be integrated with scanners and automated positioning systems for repeatable production inspection.

Polymer-Based Rubber Quality Control with TeraNIM™

TeraNIM-Aero provides a non-contact and non-destructive approach for thickness measurement and quality control of suitable polymer-based rubber components.

By combining **THz reflection measurement, material-specific refractive-index calibration and digital analysis**, the system can support **rubber thickness measurement, thickness-uniformity verification, bonded-interface evaluation and traceable aerospace manufacturing quality control.**