

Plastic Paint Coating Thickness Measurement

Terahertz Technology for Primer, Base Coat, Clear Coat or Top Coat DFT Measurements

Two-wheeler paint shops handle high part variety, complex plastic geometries and a mix of robot and manual coating operations. TeraNIM-Auto helps measure paint dry film thickness non-destructively, so production teams can reduce destructive strip checks and build a digital DFT control workflow for **plastic parts such as fenders, headlamp housings, fuel-tank covers, side trims, tail covers and grills**

Why two-wheeler plastic paint shops need better DFT control?

India's two-wheeler industry operates at very high production scale, where coating quality decisions must be fast, repeatable and production-friendly. SIAM reported 2.17 crore two-wheeler domestic sales during FY 2025–26, which translates to an average of about 18 lakh units per month, nearly 59,000 units per calendar day, or about 72,000 units per working day assuming 300 working days per year. At this scale, even small DFT variation on painted plastic parts can create a large cumulative impact in paint consumption, repainting, rework, inspection time and customer complaints.

- High-volume paint shops need faster DFT feedback
- Plastic parts require layer-wise control because primer, base coat and clear coat each affect adhesion, colour, gloss and durability.
- Non-destructive Terahertz DFT measurement can help paint-shop teams move from sample cutting/manual checks to digital, repeatable coating control.

Compared with car body paint shops, two-wheeler plastic paint shops often have more manual touch points, smaller parts, complex curves, more color variants and frequent jig changes. This makes coating consistency harder to control by periodic destructive testing alone.

Conventional Automotive Paint Thickness Measurement Challenges

Magnetic / Eddy-Current Coating Thickness Gauges

Magnetic-induction and eddy-current gauges are widely used for coating thickness measurement on ferrous and non-ferrous substrates. They are portable and useful for rapid total film-build measurements manually.

Optical Microscopy

Optical Microscopic Method gives cross-section analysis of individual layer-thickness information and it has been a golden reference method. However, it requires sample preparation, damages the inspected area. Therefore, primarily suited to laboratory validation and process audits rather than routine in-line inspection.

Ultrasonic Thickness Measurement

Portable ultrasonic thickness gauges can measure overall thickness on metallic substrates only. However, ultrasonic measurement normally requires physical probe contact and couplant (liquid

or gel) in the measurement area, which will limit its suitability to measure multi-layers thickness of each coating.

How Terahertz Technology work for Paint Coating Assessment

TeraLumen's patented Terahertz Technology System generated THz waves from 0.1 to 5THz bandwidth. The THz waves refract and reflect at every coating layer interface. When sufficient dielectric contrast is >10% between coating layers. The time separation between interface reflections contains information about the optical thickness of each coating layer.

Air → Clearcoat → Basecoat → Primer → Substrate

For a simple layer measured approximately at normal incidence:

$$d = c\Delta t / (2n_g)$$

where:

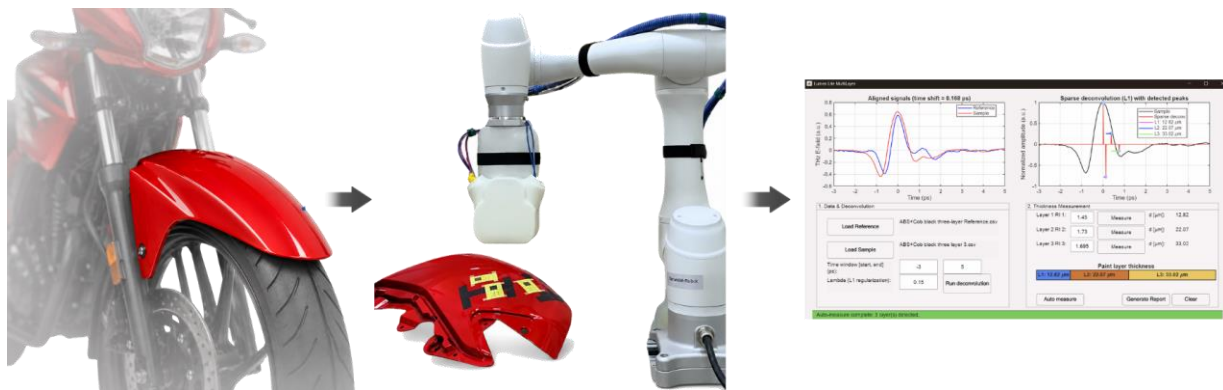
d = layer thickness

c = speed of light

Δt = time delay between the relevant interface reflections

n_g = calibrated group refractive index of the coating layer

Post acquisition of THz signal, a proprietary signal processing model helps to deconvolute the micron level coating from 20 microns of each coating. The THz signal is capable to produce ± 1 micron accuracy also.



TeraNIM Automotive Inspection Workflow

STEP 1 — Define the Inspection Requirement

The coating inspection requirement is defined based on:

- Component substrate - Metallic, plastic or composite substrate
- Coating Stack – Primer, Base Coat and Top Coat

- Reference measurement method

STEP 2 — THz Measurement Setup

The coating stack is evaluated with following information:

- THz Calibration setup
- Define Locations
- Set Tolerance Limits and alarms

The measurement setup is then optimized for the specific automotive part.

STEP 3 — Measure & Report

At each defined measurement location, THz sensor placed perpendicular to measuring area and analyses the coating layers. The THz system measures and records:

- Measurement Location
- THz Waveform
- Individual Layer Thickness
- Total Thickness
- Pass / Fail Result
- Operator Remarks

Results can be stored digitally for comparison, reporting and paint-process analysis.

Key Advantages to Automotive OEM's

- **Scrap Reduction** – Not damaging the surface to do the inspection.
- **Real-time Inspection** – Enables to inspect every component.
- **Reduce Rejections/Rework** – Insights on coating deviations.
- **Industry 4.0** – Reduction in human errors, digital transformation of manufacturing and industrial processes.

Frequently Asked Questions

Can THz measure individual two-wheeler paint layers?

It depends on layer thickness and interface contrast. Where layers are too thin or too close together, total DFT may be the more reliable production KPI.

Can it replace strip testing?

It can reduce routine destructive strip dependency after calibration and acceptance testing. Reference methods remain useful for audits and periodic validation.

Which parts are suitable?

Fenders, headlamp housings, fuel-tank covers, tail covers, side trims, grills and other painted ABS/nylon/plastic parts can be evaluated.

Can it handle color variants?

Visible color does not automatically prevent THz measurement, but every coating stack and pigment system should be validated.

What is the best first deployment?

Start with a paid lab feasibility, then a six-month rental-based production validation cell, then purchase/inline integration if success criteria are met.

Automotive Paint Quality Control with TeraNIM™

TeraNIM™ provides a non-contact approach for evaluating individual layers within validated automotive paint systems. By combining THz reflection measurement, coating-specific calibration and digital analysis, the system can support automotive paint quality control, coating-process development, OEM specification verification and automated production inspection.