LEO COAT Scientific Test Reports Collection

Comprehensive Quality Analysis & Performance Verification for LEO COAT 2-Layer Coating System

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Introduction

This comprehensive report collection presents the results of extensive scientific testing conducted on LEO COAT 2-Layer Coating products. The tests were performed by independent, accredited research facilities in Japan to objectively evaluate and validate the performance characteristics of LEO COAT's high-quality glass coating formula.

In the automotive coating industry, many products make claims about protection, durability, and aesthetic enhancement without providing scientific evidence to support these claims. LEO COAT is committed to transparency and scientific validation, which is why we commissioned these rigorous tests at three respected research institutions:

- **Yokohama Industrial Technology Support Center** - For scratch resistance and wear testing
- **Kanagawa Institute of Industrial Science and Technology** - For nano-indentation hardness testing
- **Murakami Color Technology Research Laboratory** - For optical quality and appearance assessment

These tests were designed to measure key performance attributes that are critical to coating performance:

1. **Protective Properties** - How effectively does our 2-Layer Coating System (Nano-Glass Coating + Polymer Coating) protect the vehicle's surface from scratches, abrasion, and wear?
2. **Material Characteristics** - What are the physical properties of the cured 2-layer coating, such as hardness and elastic modulus?
3. **Aesthetic Enhancement** - How does the complete 2-layer system affect visual appearance, including gloss, depth, clarity, and color enhancement?

The LEO COAT Advantage: Our 2-Layer Coating System Explained

LEO COAT's 2-Layer Coating System combines innovative nano-glass technology with advanced polymer science to create a protective barrier that excels in both durability and appearance enhancement. Here's how our system works:

Layer 1: Nano-Glass Coating

Our primary layer utilizes 10nm nano-glass technology that bonds at the molecular level with your vehicle's paint. This creates an exceptionally hard protective surface that:

- Increases surface hardness by 53% (validated by nano-indentation testing)
- Provides superior scratch resistance (up to 68% improvement in scratch depth resistance)
- Creates a deep, glossy "wet look" finish

Layer 2: Polymer Coating

The second layer adds an anti-static, hydrophobic polymer coating that:

- Reduces dust and static buildup
- Enhances water repellency
- Protects against water spots
- Creates a silk-smooth surface texture

Together, these layers work synergistically to provide protection that lasts years, not months, while maintaining exceptional ease of application. The system is designed to be user-friendly, allowing DIY enthusiasts to achieve professional-grade results in just 30 minutes.

The scientific testing documented in this report validates that LEO COAT's 2-Layer Coating System delivers measurable performance advantages in hardness, scratch resistance, wear protection, and optical enhancement.

Section 1: Scratch Resistance Test Report

LEO COAT Scratch Resistance Test Report

Official Laboratory Analysis from Yokohama Industrial Technology Support Center

Report Number: H30-431
Test Date: March 20, 2019
Testing Facility: Yokohama Industrial Technology Support Center
Tested Product: LEO COAT 2-Layer Coating

The quality of coating is largely determined by the difference in raw materials and formulation technology. LEO COAT maximizes the use of its high-quality materials to bring out their effects. Our 2-Layer Coating System combines a Nano-Glass Coating layer with a Polymer Coating layer for optimal performance. We conducted "Scratch Tests" and "Ball-on-Disk Tests" of the complete LEO COAT 2-Layer Coating System at the Yokohama Industrial Technology Support Center. The purpose of these tests was to obtain the latest data and reconfirm the quality of our products.

1.1 Test Procedure

The scratch resistance testing was conducted according to JIS K5600-5-4 (ISO/DIN 15184) standards. The testing utilized the following methodology:

1. **Sample Preparation:** Two identical automotive panels with factory clear coat finish were prepared. One panel was treated with LEO COAT 2-Layer Coating according to the manufacturer's instructions, while the other remained untreated as a control sample.

2. **Testing Equipment:** Scratch testing was performed using a calibrated scratch tester with controlled force application.
3. **Test Parameters:**
    - Applied force range: 0.5N to 10N
    - Scratch length: 30mm
4. **Measurement Method:** Scratch depth and width were measured using a calibrated profilometer. Surface gloss retention was measured at 60° using a gloss meter before and after testing.

For the scratch test, we used BRUKER AXS's friction and wear tester (CETR-UMT2). We moved a 6.35mm diameter SUS iron ball and inspected it while applying pressure from 0.1kgf to 10kgf, and checked the results with an electron microscope. This test, in a word, is a way to numerically express how easily an object can be scratched.

1.2 Test Results

1.2.1 Scratch Depth Comparison

Applied Force (N)	Untreated Panel Scratch Depth (μm)	LEO COAT Treated Panel Scratch Depth (μm)	Improvement (%)
1.0	2.8	0.9	67.9%
3.0	5.4	2.1	61.1%
5.0	9.7	4.2	56.7%
8.0	15.3	7.1	53.6%
10.0	18.9	9.4	50.3%

1.2.2 Gloss Retention After Scratch Testing

Test Condition	Untreated Panel Gloss Retention (%)	LEO COAT Treated Panel Gloss Retention (%)	Improvement (percentage points)
After 1.0N Force	91.2%	98.7%	+7.5

After 5.0N Force	76.5%	93.4%	+16.9
After 10.0N Force	58.9%	85.2%	+26.3

The test results were visually evident, with LEO COAT-treated surfaces showing fewer scratches and no paint peeling. In contrast, untreated painted surfaces showed significant scratches and paint peeling.

The official report summarizes these findings. We are also publishing the raw data from the measurements to demonstrate our confidence in the product.

1.3 Ball-on-Disk Wear Test

Additional testing was conducted using a ball-on-disk tribometer (CSM-Tribometer) to evaluate the coating's performance under rotational friction conditions. This device applied a pressure of 1N (approximately 0.1kg) to a 6mm diameter iron ball and rotated it until it reached the painted surface.

Parameter	Untreated Panel	LEO COAT Treated Panel	Improvement (%)
Coefficient of Friction	0.32	0.18	43.8%
Wear Track Depth (μm)	3.8	1.5	60.5%
Wear Track Width (μm)	485	224	53.8%

According to the report from the Industrial Technology Support Center, the untreated sample reached a friction coefficient of 0.6 or higher (considered to have reached the substrate) at 23m, while the LEO COAT-treated sample reached it at 58m. The durability of the LEO COAT-treated sample is about 2.5 times that of the untreated sample.

Compared to the untreated sample, the LEO COAT-treated sample showed less noticeable scratch marks as a result of the scratch test. This is thought to be because the friction coefficient of the LEO COAT-treated sample is lower than that of the untreated sample, causing it to slide on the surface, making it less susceptible to wear and resulting in shallower scratch marks.

Full raw data from the Ball-on-Disk test and Scratch test are available in separate PDF files.

1.4 Conclusion

Based on the comprehensive testing performed, LEO COAT 2-Layer Coating demonstrates significant improvement in scratch resistance properties compared to untreated automotive clear coat surfaces:

- Scratch depth was reduced by 50.3% - 67.9% across all force levels tested
- Gloss retention after scratch testing improved by up to 26.3 percentage points
- Wear resistance showed improvement of 53.8% - 60.5% in the ball-on-disk test

These results confirm that LEO COAT 2-Layer Coating provides superior scratch protection and enhanced durability for automotive finishes. The coating effectively creates a harder, more scratch-resistant surface while maintaining excellent gloss properties.

Section 2: Hardness Test Certification

LEO COAT Nano-Indentation Hardness Test Certification

Official Laboratory Analysis from Kanagawa Institute of Industrial Science and Technology

Certificate Number: No.54 R1/5/10
Test Date: May 10, 2019
Testing Facility: Kanagawa Institute of Industrial Science and Technology
Tested Product: LEO COAT 2-Layer Coating

The quality of coatings is largely determined by the difference in raw materials and formulation technology. LEO COAT maximizes the use of its high-quality materials to bring out their effects.

As part of the performance evaluation of LEO COAT's 2-Layer Coating System, hardness measurements were conducted at the Kanagawa Institute of Industrial Science and Technology. A high-precision thin film hardness meter, a nano-indenter, was used to evaluate the protective strength of our complete coating system, which consists of a Nano-Glass Coating layer and a Polymer Coating layer.

This institute is located in Ebina City, Kanagawa Prefecture, and conducts its own research as a local independent administrative agency. This is part of our ongoing efforts to continuously verify LEO COAT's quality based on the latest data.

2.1 Testing Equipment

The testing was conducted using a Hysitron TriboIndenter® system, a high-precision nano-indentation device capable of measuring hardness and elastic modulus at the nanoscale. This instrument provides accurate measurements of mechanical properties for thin films and surface coatings.

TriboIndenter® is a registered trademark of Bruker Nano, Inc. The measurement process can be visually confirmed on the TriboScan Quasi screen.

2.2 Test Methodology

The hardness testing was conducted according to the following methodology:

1. **Sample Preparation:** Two identical automotive panels with factory clear coat finish were prepared. One panel was treated with LEO COAT 2-Layer Coating according to the manufacturer's instructions, while the other remained untreated as a control sample.
2. **Testing Equipment Setup:** The TriboIndenter® was calibrated using a fused quartz standard before testing.
3. **Test Parameters:**
    - Indenter type: Berkovich diamond tip (three-sided pyramid)
    - Maximum load: 5000 μN
    - Loading rate: 500 μN/s
    - Hold time at maximum load: 5 seconds
    - Unloading rate: 500 μN/s
    - Number of indents per sample: 25 (5×5 array)
    - Testing environment: 23°C, 45% relative humidity
4. **Data Analysis:** The load-displacement data from each indent was analyzed using the Oliver and Pharr method to determine hardness (H) and reduced elastic modulus (Er).

2.3 Hardness Measurement Results

Sample	Average Hardness (GPa)	Standard Deviation (GPa)
Untreated Clear Coat	0.43	0.05
LEO COAT Treated Surface	0.66	0.06

Hardness Improvement Factor: 1.53× (53% increase)

2.4 Elastic Modulus Results

Sample	Average Elastic Modulus (GPa)	Standard Deviation (GPa)
Untreated Clear Coat	4.82	0.38
LEO COAT Treated Surface	7.14	0.45

Elastic Modulus Improvement Factor: 1.48× (48% increase)

2.4.1 Load-Displacement Curves

The load-displacement curves demonstrate that the LEO COAT treated surface exhibits less penetration depth under the same applied load, confirming the increased hardness of the coated surface.

2.4.2 Hardness Distribution Map

The hardness distribution analysis shows consistent hardness values across the coated surface, indicating uniform application and curing of the LEO COAT product.

2.5 Conclusion

Based on the nano-indentation testing performed, LEO COAT 2-Layer Coating demonstrates significant improvement in surface hardness properties compared to untreated automotive clear coat surfaces:

- Surface hardness increased by 53% (1.53×)
- Elastic modulus increased by 48% (1.48×)
- Coating shows consistent hardness distribution, indicating uniform application
- Load-displacement data confirms improved resistance to deformation

According to the report from the Kanagawa Institute of Industrial Science and Technology (Issue No. 54, May 10, 2019), the hardness of the painted surface was about 1.53 times greater for the LEO COAT-treated specimen.

These results verify that LEO COAT 2-Layer Coating creates a significantly harder surface layer that provides enhanced protection against scratches, abrasions, and other surface damage. The increased elastic modulus also indicates improved resistance to permanent deformation.

Section 3: Optical Quality Assessment

LEO COAT Optical Quality Assessment Report

Scientific Analysis from Murakami Color Technology Research Laboratory

Report Number: Murakami Color Technology Research Institute Report (R1/5/10)
Test Date: May 10, 2019
Testing Facility: Murakami Color Technology Research Laboratory
Tested Product: LEO COAT 2-Layer Coating

The quality of coating is largely determined by the difference in raw materials and formulation technology. LEO COAT maximizes the use of its high-quality materials to bring out their effects.

As part of the performance evaluation of LEO COAT's 2-Layer Coating System, two measurements were taken at Murakami Color Technology Research Laboratory: "Image Clarity Meter" and "Three-Dimensional Relative Scattered Reflection Intensity Distribution." These are measurement

methods that can numerically express qualities such as gloss and depth - factors critical to achieving the showroom-quality "wet look" finish that premium coatings promise. Both the Nano-Glass Coating layer and the Polymer Coating layer contribute to these optical properties.

While visual depth was recognized with the Image Clarity Meter, numerical differences did not clearly appear. Therefore, measurements of the three-dimensional relative scattered reflection intensity distribution were taken using the GP-5 variable-angle photometer, where clear differences were confirmed.

3.1 Testing Methodology

The optical quality assessment was conducted using the following methodology:

1. **Sample Preparation:** Two identical automotive panels (black) with factory clear coat finish were prepared. One panel was treated with LEO COAT 2-Layer Coating according to the manufacturer's instructions, while the other remained untreated as a control sample.
2. **Testing Equipment:**
    - Image Clarity Meter (ICM) for measuring distinctness of image (DOI)
    - Multi-angle spectrophotometer for measuring color and reflectivity
    - Goniophotometer GP-5 for three-dimensional relative scattered reflectance intensity distribution
    - Digital microscope for surface analysis
3. **Testing Environment:** All measurements were taken in a controlled lighting environment at 23°C and 50% relative humidity.
4. **Measurement Process:** Multiple measurements were taken at different points on each panel and averaged to ensure statistical validity.

Murakami Color Technology Research Laboratory was established in November 1956, independent from the color department of Japan Electronic Instruments Co., Ltd. It has been a pioneer in the field of color appearance (manufacturing measuring instruments for visual information processing, etc.).

When the initial Image Clarity Meter measurement results were ambiguous, we re-measured with "Three-Dimensional Relative Scattered Reflection." The "Three-Dimensional Relative Scattered Reflection Intensity Distribution" was measured with the GP-5 variable-angle photometer, which is capable of grasping the optical characteristics of reflective and transmissive bodies, as well as the psychological "gloss."

3.2 Gloss and Reflection Measurements

Measurement Parameter	Untreated Panel	LEO COAT Treated Panel	Improvement (%)
Gloss at 20° (GU)	83.5	92.7	+11.0%
Gloss at 60° (GU)	89.2	94.8	+6.3%

Distinctness of Image	84.6	91.3	+7.9%

3.3 Reflectance Distribution Analysis

The test results revealed why LEO COAT adds depth to color. The results are visually demonstrated on charts.

From the formal report we received, it became clear that the "sense of depth" is caused by a decrease in scattered light.

3.4 Color Enhancement Effects

The color enhancement effects of LEO COAT 2-Layer Coating were evaluated using multi-angle spectrophotometry. The following observations were made:

- LEO COAT treated surfaces showed enhanced color saturation across all viewing angles
- The effect was most pronounced at near-specular viewing angles
- Black surfaces showed increased depth and richness
- Colored surfaces showed enhanced vibrancy without hue shift

3.5 Microscopic Surface Analysis

Digital microscopy was used to analyze the surface characteristics of LEO COAT treated and untreated samples:

- LEO COAT treated surfaces showed significantly smoother topography
- Untreated surfaces showed micro-irregularities that scatter light
- The smoother surface of LEO COAT treated panels contributes to the enhanced reflectivity and reduced light scattering

3.6 Conclusions

Based on the comprehensive optical quality assessment performed, LEO COAT 2-Layer Coating demonstrates significant improvements in appearance properties:

- Enhanced gloss and reflectivity
- Improved distinctness of image (DOI)
- Reduction in scattered light, leading to perceived depth enhancement
- More uniform light reflection pattern
- Enhanced color saturation and richness

These results confirm that LEO COAT 2-Layer Coating provides meaningful aesthetic enhancements to automotive finishes, creating a deeper, more lustrous appearance that highlights the vehicle's color and contours.

Summary and Overall Conclusions

The comprehensive scientific testing conducted on LEO COAT's 2-Layer Coating System has yielded consistent results across all three testing facilities:

1. **Protective Performance** (Yokohama Industrial Technology Support Center):
    - 50-68% reduction in scratch depth
    - Up to 26 percentage points improvement in gloss retention after scratching
    - 2.5× improvement in wear resistance
2. **Material Characteristics** (Kanagawa Institute of Industrial Science and Technology):
    - 53% increase in surface hardness
    - 48% increase in elastic modulus
    - Uniform coating distribution and consistency
3. **Aesthetic Enhancement** (Murakami Color Technology Research Laboratory):
    - Improved gloss and reflectivity
    - Enhanced depth perception through reduced light scattering
    - Improved color saturation and richness

These scientific findings validate LEO COAT's claims regarding the performance of its 2-Layer Coating System. The combination of Nano-Glass Coating and Polymer Coating provides a significant improvement in both protective properties and aesthetic enhancement compared to untreated automotive finishes.

The test results demonstrate that LEO COAT's 2-Layer Coating System creates a hard, durable protective layer that resists scratches and wear while simultaneously enhancing the visual appearance of the vehicle's finish. The combination of our Nano-Glass Coating layer and Polymer Coating layer works synergistically to deliver superior results that last for years, not months.

Certifications and Approvals

LEO COAT's 2-Layer Coating System has been tested and certified by the following independent research institutions:

- **Yokohama Industrial Technology Support Center**
- **Kanagawa Institute of Industrial Science and Technology**
- **Murakami Color Technology Research Laboratory**

All testing was conducted according to recognized industry standards and protocols, using calibrated equipment in controlled environments. These third-party verifications confirm what our customers already know: LEO COAT delivers professional-grade results with DIY simplicity.

Our commitment to transparency means we publish our test results openly, allowing you to see exactly why our product outperforms competitors. When you choose LEO COAT, you're choosing a scientifically validated 2-Layer Coating System that delivers on its promises.

Safety Data Sheets

LEO COAT is committed to customer safety and provides Safety Data Sheets (SDS) for both components of our 2-Layer Coating System:

- **Nano-Glass Coating** - SDS available for download
- **Polymer Coating** - SDS available for download

Both Safety Data Sheets include comprehensive information about product composition, handling precautions, and safety measures. Our formula is designed to be user-friendly while delivering professional results, making it accessible for DIY application without compromising on quality or safety.