Technical selection guide for PP/TPO compounders, Tier-1 suppliers, and automotive material teams

CHENGDU, SICHUAN, CHINA, September 30, 2026 / EINPresswire.com/ -- A PP/TPO automotive interior compound can meet its mechanical requirements and still fail visually because of scratch whitening, mar marks, gloss changes, or poor long-term surface stability.



This challenge is particularly relevant for door panels, dashboards, center consoles, instrument panels and pillar trims, where surfaces are repeatedly exposed to touching, rubbing, cleaning, luggage contact and temperature changes.

For talc-filled PP/TPO, scratch visibility can become even more pronounced because surface damage may make lighter filler-containing regions more visible, especially on black, gray, and other dark-colored components.

This is why selecting an anti-scratch additive for PP/TPO automotive interior parts should not be based only on the lowest initial Delta L.

Can the additive maintain the required scratch resistance and surface appearance over time without introducing unwanted changes in surface stability, gloss, odor, or VOC performance?

This guide provides a practical selection framework for compounders, Tier-1 suppliers, automotive material engineers, and technical procurement teams evaluating anti-scratch solutions for PP/TPO interior compounds.

Why Do PP/TPO Automotive Interior Parts Show Visible Scratches?

PP and TPO are widely used in automotive interiors because they offer an attractive combination of low density, processability, stiffness, impact performance and cost efficiency.



Their surface appearance, however, can be sensitive to mechanical damage. When a molded surface is scratched, the damaged region reflects and scatters light differently from the surrounding area. Even when the physical groove is relatively shallow, the resulting optical contrast can make the scratch highly visible.

In automotive scratch evaluation, this change is often expressed through Delta L, or the change in lightness between the scratched and original surface under defined test conditions. A lower Delta L generally indicates lower visible scratch contrast.
However, Delta L should not be interpreted in isolation. Applied load, stylus geometry, surface texture, pigment, filler loading, conditioning and test method can all influence the result.

Why Is Talc-Filled PP/TPO More Difficult to Protect?

Talc is commonly incorporated into automotive PP/TPO compounds to improve stiffness, dimensional stability and thermal performance. At the same time, talc can make visible scratch whitening more difficult to control.

When scratching disrupts the polymer-rich surface, lighter filler-containing regions may become exposed or optically more noticeable. On dark-colored molded parts, this can appear as a white or light-gray scratch mark.

The same anti-scratch additive may therefore perform differently in neat PP, a lightly filled PP compound and a highly filled PP/TPO formulation.

For practical material development, talc loading should be treated as one of the first formulation variables to evaluate.

How Do Anti-Scratch Additives Improve PP/TPO Surface Performance?

One important approach is to reduce friction between the molded polymer surface and the object moving across it. Lower friction can reduce the severity and depth of scratching. A

shallower and smoother damaged region may scatter less light, helping reduce visible scratch contrast.

Silicone-based technologies are widely used for this purpose because they can modify the surface behavior of PP/TPO compounds while being incorporated directly during compounding. High- and ultra-high-molecular-weight silicone masterbatches also provide a convenient pelletized form for handling and dosing.

Silicone concentration alone, however, does not determine the final result. The additive must also be sufficiently compatible with the polymer matrix.

For demanding automotive applications, anti-scratch performance is therefore best considered as a balance of surface modification + polymer compatibility + long-term stability.

Six Factors to Consider When Selecting an Anti-Scratch Additive

1. Polymer Matrix

Start with the actual resin system. PP homopolymer, PP copolymer, and PP/EPDM-based TPO may not respond to the same anti-scratch additive in the same way. Compatibility influences additive dispersion, phase stability and long-term surface behavior. A PP-Homo-rich formulation may therefore require a different additive approach from a PP copolymer-rich or TPO system.

2. Talc and Filler Loading

Talc loading can significantly influence scratch visibility and additive response. A grade and dosage that perform well in one PP/TPO compound may not provide the same result when filler loading changes. Whenever possible, the anti-scratch additive should therefore be evaluated in the actual filled formulation rather than only in neat resin.

3. Target Scratch Test and Delta L

A good selection process starts with the test requirement rather than the product. Automotive programs may use procedures such as PV3952, GMW14688 or customer-specific scratch methods. The final result can depend on applied load, stylus geometry, surface grain, conditioning, part color, and measurement method. For this reason, a reported Delta L value is most meaningful when the corresponding test conditions are also known. Instead of asking which additive gives the strongest anti-scratch effect, it is more useful to define the required test method and target Delta L.

4. Aging and Long-Term Surface Stability

A good initial scratch result does not automatically mean that a formulation is suitable for long-

term automotive use. Heat aging, UV exposure and temperature cycling may reveal changes that are not visible immediately after molding. For automotive interior materials, scratch resistance should therefore be evaluated both before and after the relevant aging conditions.

5. VOC, Odor and Fogging

Automotive cabin materials are evaluated as complete formulations. An anti-scratch additive should therefore also be considered in relation to VOC, odor and fogging requirements. Final compliance should be confirmed using the complete compound, including resin, filler, pigment, stabilizer and other additives, according to the applicable OEM or project specification. The additive should support the formulation target rather than be treated as an independent guarantee of final compliance.

6. Gloss, Grain and Tactile Quality

Scratch resistance should not be improved at the expense of the intended surface design. A matte dashboard, fine-grain door trim or low-gloss center console has a specific visual and tactile target. The selected additive should therefore also be evaluated for its effect on gloss, grain definition, surface uniformity, color consistency and hand feel. For premium automotive interiors, the best result is not simply a lower Delta L. It is a surface that remains visually and tactilely consistent while becoming more resistant to scratch and mar damage.

Anti-Scratch Technologies Compared

Technology

Main Benefit

Main Point to Evaluate

Fatty amide / conventional slip agent

Cost-effective lubrication

Migration and aging behavior

Wax/lubricant

Slip and processing improvement

Formulation dependency

Silicone oil

Strong lubrication

Migration and matrix compatibility

UHMW silicone masterbatch

Durable surface modification and convenient pellet form

Polymer compatibility and dosage

Organically modified siloxane

Long-term surface modification

Interaction with polymer and filler system

Surface coating

High level of surface protection

Additional process and cost

There is no universally superior technology for every formulation. For molded-in-color PP/TPO automotive parts, masterbatch-based technologies can be particularly attractive because surface-performance modification can be incorporated directly during compounding and molding.

Why Initial Delta L Is Not Enough?

Two formulations may show similar initial scratch performance immediately after molding. After thermal or UV aging, however, one may retain a dry, uniform and stable surface while another may show changes in gloss, surface feel or scratch resistance.

From an automotive engineering perspective, these formulations are not equivalent.

A more meaningful evaluation should therefore extend beyond the initial scratch result and consider initial scratch resistance > aging > long-term surface stability > VOC/odor performance > aged scratch resistance.

The most suitable anti-scratch solution is not necessarily the one that produces the lowest initial Delta L. It is the one that maintains the required surface performance under the relevant application and aging conditions.

Performance Validation Beyond Initial Scratch Resistance

For automotive PP/TPO anti-scratch modification, performance evaluation should extend beyond a single initial scratch test. SILIKE has conducted relevant evaluations on selected anti-scratch formulations and application systems, covering immediate scratch resistance, long-term scratch-resistance stability, aldehyde/ketone and VOC-related testing, odor evaluation, thermal aging and long-term surface stability.

Figure 1. Relevant performance evaluations of selected SILIKE anti-scratch solutions for automotive PP/TPO applications, including immediate and long-term scratch resistance, aldehyde/ketone and VOC-related testing, odor evaluation, thermal aging, and long-term surface stability.

Technical Note: The evaluations shown above are based on selected formulations and specified test conditions. Actual performance may vary depending on polymer system, filler loading, formulation, processing conditions, and test method. Final product suitability should be verified in the customer's actual formulation according to the applicable OEM or project requirements.

Anti-Scratch Additive Selection Matrix for PP/TPO Automotive Interiors

Application or Formulation	Main Selection Priority
High-talc PP/TPO	Scratch whitening and filler compatibility
Black or dark-colored door panel	Low visible scratch contrast
Matte dashboard	Scratch resistance with gloss retention
Fine-grain molded surface	Surface uniformity
High-touch center console	

Mar resistance and tactile quality

High-temperature interior part

Long-term surface stability

Low-VOC compound

VOC, odor and fogging

PP-Homo-rich compound

PP-Homo compatibility

PP copolymer / TPO

Long-term matrix compatibility

OEM-qualified project

Target scratch test and aging protocol

This matrix provides a useful first screening before formulation trials begin.

SILIKE Anti-Scratch Masterbatch Selection for PP/TPO

SILIKE offers a series of PP-based silicone anti-scratch masterbatches for automotive PP, TPO, and related thermoplastic systems. The portfolio includes Anti-scratch Masterbatch LYSI-306, Long-Term Scratch Resistance Additive LYSI-306C, High Scratch Resistance Silicone Masterbatch LYSI-306H, Non-Migrating, Non-Sticky, High-Temperature Stable Additive LYSI-306G, and Ultra-Low VOC, Non-Tacky Anti-Scratch Additive LYSI-906, with different grades positioned around polymer compatibility, long-term scratch performance, surface stability, and low-VOC requirements.

Quick Selection: Which SILIKE Grade Should You Start With?

Main Requirement

Suggested Starting Grade

General PP/TPO or talc-filled compound

LYSI-306

PP copolymer / TPO requiring demanding long-term scratch performance

LYSI-306C

PP-Homo-rich formulation or compatibility concern

LYSI-306H

Non-migration, non-tackiness, or thermal surface stability

LYSI-306G

Low VOC, low odor, and high-touch interior surface

LYSI-906

The appropriate starting grade depends primarily on the PP matrix and the dominant surface-performance requirement. Final product and dosage should always be confirmed in the actual customer formulation.

Internal Test Snapshot: Silicone Anti-scratch Masterbatch LYSI-306C

In selected SILIKE internal evaluations, long-term scratch resistance agent LYSI-306C demonstrated low visible scratch contrast under defined test conditions.

Test Item

Internal Evaluation

Material system

Selected PP/TPO formulation

LYSI-306C dosage

1.5 wt%

Scratch load

10 N

Delta L

< 1.5

PV3952 target

Met in evaluated formulation

GMW14688 target

Met in evaluated formulation

These results are formulation- and test-condition-specific. Actual performance may vary with PP/TPO grade, talc loading, pigment, surface texture, processing conditions and test protocol. This quantitative snapshot should be considered together with the broader performance evaluations above rather than as a standalone indicator of automotive suitability.

Application Case Improving Scratch Resistance in Talc-Filled PP/TPO Door Trim

A manufacturer developing a dark-colored PP/TPO compound for automotive door trim experienced visible whitening following scratch testing. The base formulation was a PP copolymer/TPO system filled with approximately 20 wt% talc, developed to achieve lower scratch contrast, stable surface gloss, and enhanced long-term durability.

Under the selected scratch-test conditions, the unmodified compound showed an initial ΔL

of approximately 4.1. To resolve the severe scratch whitening and meet strict OEM requirements, SILIKE non-migrating anti-scratch additive LYSI-306G was evaluated.

At a 1.5 wt% loading, the modified compound successfully reduced scratch contrast, achieving an initial ΔL< 1.5 without altering the intended molded appearance.

Following a defined thermal-aging cycle, the LYSI-306G modified compound maintained a stable ΔL< 1.5, compared with approximately 4.4 for the unmodified control. Additionally, no surface tackiness or visible additive exudation occurred after thermal exposure.

How Much Anti-Scratch Masterbatch Should Be Used?

There is no universal dosage for every PP/TPO formulation. Depending on grade and formulation, SILIKE PP-based anti-scratch masterbatches can generally be evaluated within an approximate 0.5-5 wt% range.
The optimum level depends on the polymer system, filler loading, and target surface performance. Instead of evaluating only one concentration, a better development approach is to compare several dosage levels while keeping the base formulation and processing conditions

unchanged.

The optimum dosage is the one that achieves the required scratch performance while maintaining the overall balance of the compound. Higher dosage should not automatically be considered better.

How to Design a More Meaningful Anti-Scratch Trial

A practical anti-scratch trial does not need to be complicated. Start with the untreated formulation as the control.

Then evaluate two or three additive levels while keeping extrusion conditions, injection-molding parameters, mold texture, and conditioning consistent. Measure the initial scratch result and inspect the surface appearance. After the required thermal or UV aging, repeat the evaluation under the same conditions.

The most useful comparison is control vs. modified compound, before and after aging. This makes it easier to distinguish durable surface modification from a temporary lubricating effect.

If the first trial does not achieve the target, increasing dosage should not automatically be the next step. The polymer matrix, talc level, surface texture, additive compatibility and test conditions should also be reviewed.

Frequently Asked Questions

What is the best anti-scratch additive for PP automotive interiors?

There is no universal best anti-scratch additive for every PP formulation. The correct choice depends on the PP matrix, talc loading, elastomer phase, color, surface texture, target Delta L, aging conditions and VOC/odor requirements. For automotive applications, polymer compatibility and long-term surface stability should be evaluated together with initial scratch performance.

Does talc affect PP/TPO scratch resistance?

Yes. Surface damage in talc-filled PP/TPO can make lighter filler-containing regions more visible, increasing scratch whitening on dark-colored parts. As filler loading changes, the optimum anti-scratch additive grade and dosage may also change.

Can silicone masterbatch improve PP/TPO scratch resistance?

Yes. High-molecular-weight silicone masterbatches can modify PP/TPO surface behavior and reduce friction, helping reduce visible scratch and mar damage. For example, SILIKE Anti-scratch masterbatch; however, actual performance depends on polymer compatibility, dosage, filler loading, surface design, and the complete compound formulation.

Why should scratch resistance be tested after aging?
Because an additive that performs well immediately after molding may behave differently after thermal or UV exposure. Aging helps determine whether the modified surface can retain the required appearance and scratch performance over time.

Selecting the Right Anti-Scratch Additive for Your PP/TPO Compound

Selecting an anti-scratch additive for automotive interiors is ultimately a materials-balancing decision. A successful formulation needs to balance scratch resistance with aging stability, polymer compatibility, surface appearance, VOC/odor requirements, and processability.

That is why the polymer matrix, talc content, and target automotive test should be defined before the additive is selected.

For a more targeted SILIKE automotive interior scratch resistance additive recommendation, provide the PP/TPO type, talc content, automotive application, current anti-scratch additive and dosage, target PV3952/GMW14688 or Delta L, aging requirement, VOC/odor requirement, and the current surface problem.

Based on these formulation details, SILIKE can recommend suitable starting grades and dosage ranges for silicone anti-scratch masterbatches, non-migrating anti-scratch additives, and low-VOC anti-scratch additives for laboratory trials or production-scale evaluation in PP/TPO compounds for automotive interiors.

These solutions are also suitable for automotive interior compounds based on PP/TPO, ABS, PC/ABS, TPE/SEBS, TPU, PA, and glass-fiber-reinforced materials. They help enhance scratch and mar resistance, improve surface quality and processing efficiency, and support long-term low-VOC performance.

Learn more about SILIKE Anti-Scratch Masterbatch Solutions: www.siliketech.com/anti-scratch-masterbatch-for-automotive-interiors/
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