

Service Information

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Category S	Technical	Ref. No. E031/10	Page 1 of 12
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Applicable Model All models	Applicable Countries or Specifications Worldwide		

Subject: Tips for Paint Damage Caused by External Factors

DESCRIPTION

This Service Information is to inform the distinguishing features of paint damages to support your diagnosis and judgment to determine whether they are caused by external factors or not.

When customers point out those concerns, please take care of them properly by utilizing the following description.

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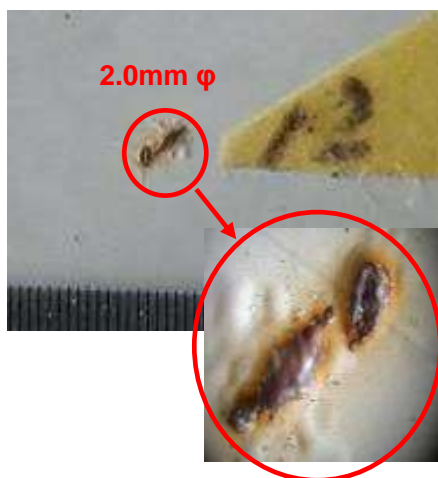
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1.Coating damage caused by natural environment and other chemical factors

(1)Bug shell



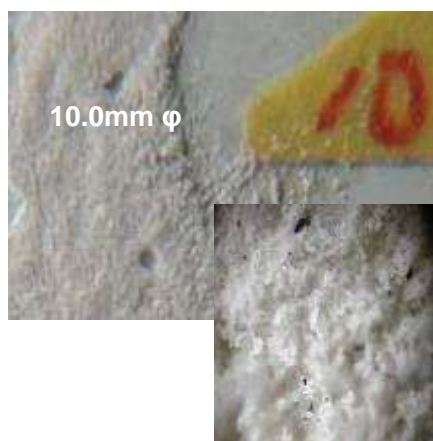
<Factor>

While driving, when a bug hits the vehicle, the bug is crushed with the impact, spraying its body fluid. Enduring contact of the body fluid (organic acid) to coating causes damage to the coating. Coating dissolution by acid has the same mechanism as dissolution by acid rain. But the bug's body fluid is more acidic, and the bug shell plays a role like a packing, making it more difficult to move body fluid. So it tends to stay in the same spot, causing a bigger degree of damage to coating.

<Treatment>

To protect coating from bugs, there's no effective prevention measure for bugs attached while driving. Then, wash the vehicle in water right away when the bug is attached. If it's not possible, wipe it off with a cloth or tissue paper etc.

(2)Bird and bug droppings

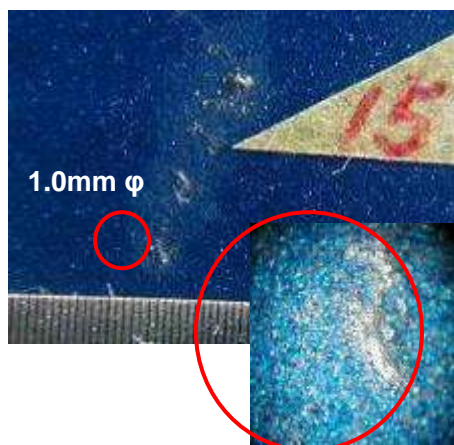


<Factor>

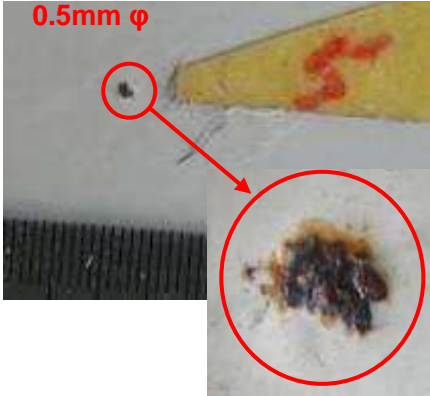
Coating damage by bird or bug droppings differs depending on types of bird's or bug's feed, amount of droppings, weather (temperature) condition, elapsed time etc. Level of damage also varies ranging from color change to top coat peeling. Coating dissolution by acid is the same one as dissolution by acid. But droppings of birds which ate acidic feed such as bug, fish and fruit are more acidic, making the degree of coating damage heavier.

<Treatment>

To protect coating from bird or bug droppings, wash the vehicle with water right away after the bird/bug droppings attached to the coating. If it's not possible, wipe it off with a cloth or tissue paper etc.



(4)Iron powder

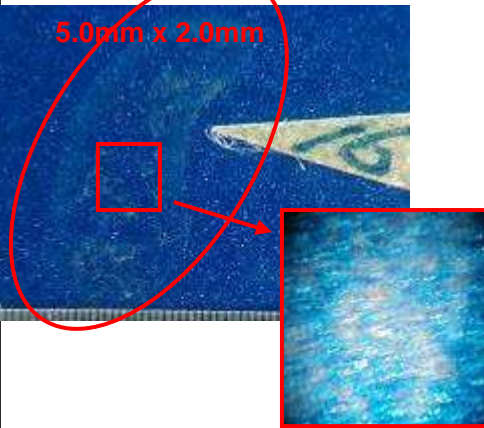


0.5mm φ

<Factor>
Iron powder generated by casting plant and railway track etc. sticks into the top coating, being exposed to rain or water in the air and leading to poor appearance due to corrosion. Also, it causes dullness due to rough coating surface, and unevenness of wax wipe-off.

<Treatment>
Corroding iron powder on the coating can be removed by cleaner or compound. But iron powder remover is most efficient.

(5)Water marks




5.0mm x 2.0mm

<Factor>
Stain which looks like dried waterdrop. Contaminant included in water is left after water evaporation. Water is prone to absorb contaminant easily.

<Treatment>
It can be prevented by wiping waterdrop off completely, instead of drying waterdrop naturally.

(6)Fruits



<Factor>
While the vehicle is parked under or nearby a tree, fruits (such as cherry fruits etc.) drop from the tree to the paint surface. Paint is damaged due to fruit juice (organic acid) attaching to the paint surface.
Though the dissolution of paint surface caused by acid has the same mechanism as acid rain, acidity of fruits is higher than that of acid rain. In addition, fruit itself plays a role like a pad which makes fruit juice difficult to move and stay in the same spot, resulting in a larger degree of the paint surface damage.

<Treatment>
Like insect's dead body, we don't have any effective preventive measures for fruits. But in order to protect the painting, if there's anything attached to the painting surface, wash it away with water immediately. If it cannot be washed with water, wipe it out with fabric or tissue paper etc.

(7) Acid rain



Due to high temperature under the sun, acid in the waterdrop was condensed and penetrated into the paint coating, causing the depression.

<Factor>

Acid raindrop falls on the paint surface, becomes more acidic after evaporation, and etches off the paint surface.

<Cause>

If the attached raindrop is left untouched, acid is condensed after water evaporation, which decreases pH value.

Also, pH value is partially lowered in the water evaporation process of objects dropped to the paint (Ex. sand, pollen, pesticides, sooty smoke).

Due to temperature rise, paint is softened and vulnerable to acid penetration, being prone to be damaged. If body temperature becomes 80 degrees C or more, the damage will be heavier.

<Countermeasure>

Explain that it is an external factor, not a paint failure at production. This will not be handled as warranty repair.

If it is like a stain or similar with no depression confirmed by the fingertip, polish it with compound. If it doesn't disappear, polish it with waterproof paper and compound for finishing. If it's not fixed yet, grind it smoothly and paint it again.



Due to high temperature under the sun, acid in the waterdrop penetrated into the paint coating, damaging aluminum pieces.



Trace of the paint surface etched off by acid because waterdrops were left under the scorching sun.



After rain, raindrops were left under the scorching sun, causing paint damage due to acid.

(8) Sooty smoke



After rain, raindrops were left under the scorching sun, paint surface was eaten away by acid.

<Factor>

Substances emitted by the plant (sooty smoke) fly and fall on the body, damaging the paint coating after they are mixed with rain water and become acid water.

Additionally, they are mixed with rain or moisture in the atmosphere, become acid and fall down as acid rain, which penetrate in the paint coating and cause a ringed mark like a spot or paint crack.

<Cause>

Smoke from the plant pours on the vehicle body and is mixed with rainwater or dew. If it's left as is, acid is condensed due to water evaporation and lowers the pH value. Additionally, pH value is partially lowered through the evaporation process of droppings on the paint surface.

Paint coating is softened by temperature rise and becomes vulnerable to acid penetration, being prone to be damaged (Body temperature sometimes become even 80 degrees C.)

<Countermeasure>

Explain that it is an external factor, not a paint failure at production. This will not be handled as warranty repair.

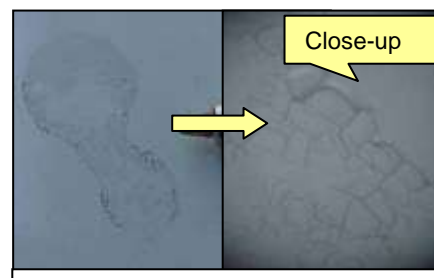
If it is like a stain, polish it with compound. If it doesn't disappear or paint coating is removed, polish it with waterproof paper and compound for finishing. If it's not fixed yet, grind it smoothly and paint it again.



Paint was etched off and removed.



After rain, acidic water gathered partially, penetrated in the paint and caused peel-off. (roof rail)



Acid level of waterdrop increased due to temperature rise, which damaged the paint coating and caused the paint crack.

Key points of interview with customers

Confirm occurrence condition of ringed marking or stain and ask if the vehicle is parked outdoor or if there's any smoke emitted by a plant close to the place where the vehicle has been parked.

<In order to protect the paint coating from acid rain and sooty smoke>

- Be careful of mist and beginning of rain which have lower pH values.
- After rain, wash the vehicle with clean water and wipe it off to prevent waterdrops from remaining on the paint surface.
- When soot and smoke are attached (in case of lots of black powder attached), remove it with water-washing, feather duster, and air blow etc.
- Park the vehicle indoor or prevent damage by putting the body cover on it.
- Apply body coating to the paint surface. (Even though body coating is applied, it cannot prevent damage completely.)
- Plastic bumper is less likely to be damaged as the surface temperature is low.


(9)Other coating damages

There are other coating damages as follows.

- Natural environment: Damage caused by tree sap which tends to be generated during plant's growth period from spring to summer, salt damage caused by salt sea breeze in seaside area, snow melting agent, inorganic salts included in deicer as freezing point lowering agent.
- External factor: Coating damage caused by battery fluid, scratch by car washing machine and hand polishing, coating contamination due to spraying or splash of roller painting.

2. Coating damage caused by physical factors

(1) Scratch



<Factor>
- A symptom that external factors scrape off the paint surface, causing diffuse reflection of the scraped area that looks white.

<Cause>
- The surface was wiped off with foreign material attached.
- When the surface was polished with wax or compound, polished finish and wipe-off wasn't enough.
- The bird dropping was wiped off without knowing that it included pebbles.
- Paint was scraped off due to hit of clothes and bags etc.

<Countermeasure>
- Explain this is not a production concern of paint. Will not be handled as warranty repair.
- Minor scratch can be polished with compound. If it's a severe scratch, Polish it with #2000 or equivalent waterproof paper and finish it with compound. If it's not fixed yet, grind it smoothly and paint it again.

Polishing flaw due to insufficient finish with wax or compound.



Mark of polishing flaw caused by car-washing machine brush.

Scratch caused by hit of clothes, bag, or luggage etc.

Scratch due to too much polishing with wax or compound (It appears to have included foreign objects like dirt, sand etc.)

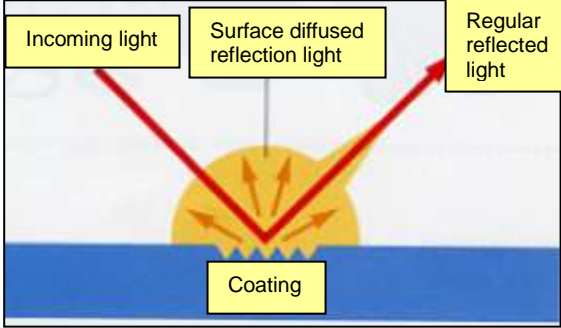
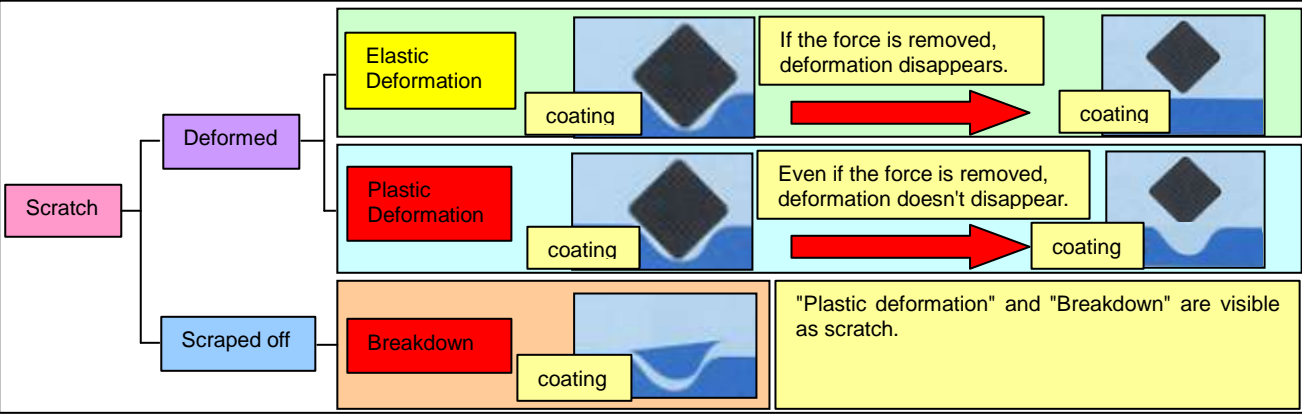
Key point of prevention and advice

- If the dirt or sand is attached to the vehicle, spread water to float the dirt or sand and wash the surface lightly.
- Don't use nylon fiber for car-washing and wiping because the fiber is hard and is likely to cause scratch. Use soft cloth like chamois leather instead.
- If a car-washing machine is used, make sure that a soft material is used for the brush on the machine.
- Before waxing, make sure that no foreign material is attached to the body and the sponge. Also, in case of waxing, be sure to wipe down all of the waxed area.

Technical knowledge

- As shown in the right picture, scratch looks white because surface of the scratch reflects diffusely.
- As shown in the picture below, the scratch is created because paint coating is scraped or depressed due to foreign material under surface and hardness of material for wiping.

1. Very little flaw that disappears if the force is removed is elastic deformation.
2. If pushing force is strong, deformation doesn't disappear even though the force is removed. Deformation becomes large and plastic deformation exceeding elastic deformation.
3. If the deformation increases further, it causes coating breakdown.

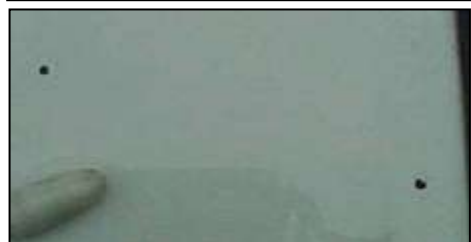
Scratch

- Deformed
 - Elastic Deformation: If the force is removed, deformation disappears.
 - Plastic Deformation: Even if the force is removed, deformation doesn't disappear.
- Scraped off: Breakdown. "Plastic deformation" and "Breakdown" are visible as scratch.

(2)Chipping



Mark of coating removal caused by flying stone. (Hood)



Mark of coating removal due to pebbles scattered by helicopter's wind pressure. (The whole surface exposed to wind had the same symptom. Same as glass.)



Flying stone hit hood and front fender, caused scratch, which caused rust.

<Factor>

Flying stones etc. hit the coating while driving or under strong windy weather (typhoon), removing the coating with a shock.

<Cause>

On the road surface, there're stones scraped off from the asphalt road surface. Driving tires and wind pressure (negative pressure) curl up and scatter them. Then, these stones hit the following or overtaking vehicle, causing chipping (broken coating). Also, when the vehicle follows a truck carrying gravel etc., gravel drops from the platform. Or when the vehicle follows another vehicle on a dirt road, it may be damaged by chipping.

In some cases, strong wind like typhoon curls up gravel and causes chipping.

<Countermeasure>

- Explain this is not a production concern of paint. (external factor). This will not be handled as warranty repair.
- Confirm the state of peeling, if the base coat isn't visible, polish the surface with compound. If it's not fixed yet, polish it smoothly and paint it again.
- As a quick cure, remove the foreign material in the peeled area and paint it with touch-up paint.

Explanation points to customers

As flying stones are hard to see, it's impossible to avoid them while driving. If the body is damaged, try to fix it early to prevent rust from appearing. Even the glass may have a flaw due to flying stones.

Explain that the coating has been damaged because the impact of stone hitting is strong enough to damage a hard glass as well.

To preserve the coating, keep a safe distance to the vehicle ahead and drive the vehicle at a moderate speed.



Flying stone hit windshield and caused flaw. (White impact mark is visible.)

<Additional point> Foreign materials will be attached to or the bare sheet metal that appears if the coating area is peeled off by stone hit. If it's left untouched, it's damaged by rust due to rain water etc.

How to verify chipping

<Loupe check>

- Confirm if the peeled area is scraped off at a sharp angle.
- Confirm if dust is attached to the peeled area.
- Confirm if the coating is burned and whitened at the peeled area due to the impact (heat)

<Visual and loupe check>

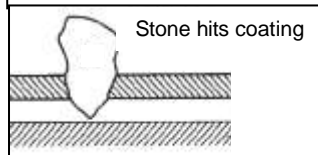
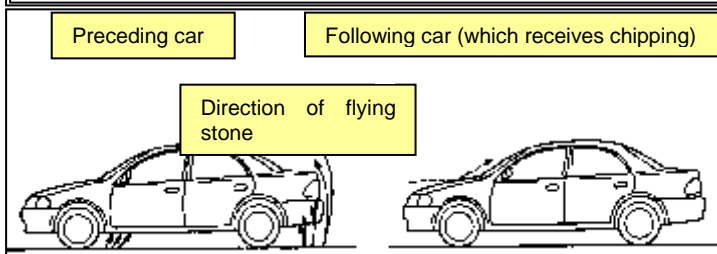
- Confirm if the glass surface has a flaw. (Tiny white scar)

◆ Generating mechanism

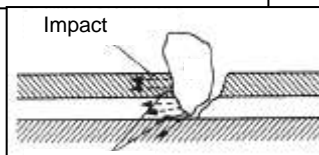
- While driving, stones and gravel hit the vehicle after they are caught by the preceding vehicle's tire. Or they hit the vehicle after they are curled up by the wind pressure. Also, the vehicle's own tire curls up gravel, hitting under floor, tire house, and side area etc., causing peeling.
- A tall vehicle with steep wall surfaces such as station wagon tends to be affected by flying stone more and cause coat peeling. However, coating damage occurs even on a vehicle with gentle wall surfaces.



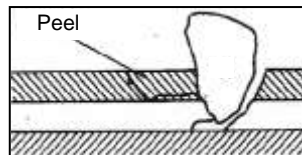
Right after the peeling, impact area is burned and whitened. Edge of peeled area is scraped off at a sharp angle.



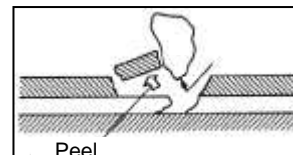
1. The stone hits and breaks the coating, which triggers peeling.



2. Impact force transferred into the coating cause partial crack.



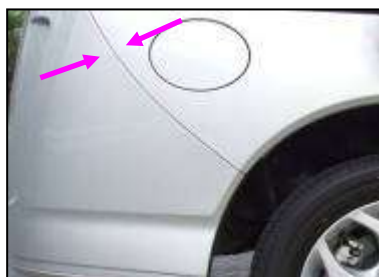
3. The weakest layer or the space between layers with weak adhesion is slightly peeled off.



4. Due to reaction to impact force of stone hit, it is completely peeled off and gone.

3.Paint Quality (Non production failure)

(1) Wrong color, color deviation (Body, Bumper etc.)



<Factor>

- A phenomenon that colors of body and bumper (plastic) paint look different when the vehicle is seen under the sun.

<Cause>

- Vehicle body and plastic parts (bumper, molding etc.) are painted in different plants, using paints with different ingredients.⁽¹⁾ Although metallic paint is sprayed with the automatic painting machine,⁽²⁾ colors of paint look different because configuration of aluminum pieces included in paint is uneven and doesn't face in the same direction⁽³⁾ due to difference of production plant.

As for solid paint, due to difference of paint ingredients and production plants, hues after dry show subtle difference.



<Countermeasure>

- This phenomenon is not a production concern of paint. This will not be handled as warranty repair.

- As described in the above "Cause", even though the bumper is replaced and painted again, it's difficult to match it with body color completely, with some color difference left.



It looks different depending on angles or light conditions.



Same symptom is seen at competitor's vehicle as well.

Key point of maintenance and explanation

- It is recommended to keep MC paint as is. It won't be changed even with part replacement and repainting.
- As electrostatic painting is done by the automatic painting machine at the production line, configuration of aluminum pieces is evenly laid out. But repainting is mostly sprayed by an operator. So, it isn't sometimes finished like MC original paint quality. In addition, if the repainting is made, color becomes different in some cases due to color change etc. according to daytime ultraviolet rays and aging.
- Since competitors adopt the same painting method, same symptom is seen at their vehicles as well.

(2) Metallic mottling



<Symptom>

- When the metallic base is painted, the surface looks uneven because the configuration of aluminum pieces in the base coat isn't even. Also, when clear paint is made after base color painting, base color in the under layer is melted by the solvent of the clear paint, causing uneven color appearance due to movement of aluminum pieces. (More prone to appear in light colors.)

<Cause>

- As electrostatic painting is done by the automatic painting machine at MC production plant, the color rarely looks uneven. However, painting by an operator causes partially-thickened or thinned paint thickness, depending on speed or distance of paint spraying. Then, amount of solvent (incl. clear, thinner) may vary in some cases. Also, dispersion condition of aluminum pieces doesn't become even because viscosity of the metallic base clear paint is too low, resulting in finished surface with mottled appearance due to uneven configuration of aluminum pieces facing in different directions,⁽³⁾ which are contained in the paint.



<Countermeasure>

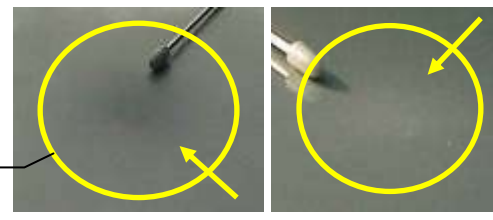
- As this symptom is not a paint failure, please explain it to a customer without part replacement or repainting.
- Even the repainting is made, it's difficult to match the color with surrounding area because the configuration of aluminum pieces becomes uneven as stated in above "Cause" section, resulting in color difference or mottling.

Same symptom is seen at competitor's vehicle as well.

Key point of maintenance and explanation

- It is recommended to keep it as is. Even repainting is made, it won't be finished like the condition at MC shipment.
- In the production line, aluminum pieces are evenly arranged as electrostatic paint is performed by the automatic painting machine. Unless the overall paint is implemented, the entire paint quality will not be equal.

Repainting may cause mottling that looks light or dark depending on viewpoint angles.

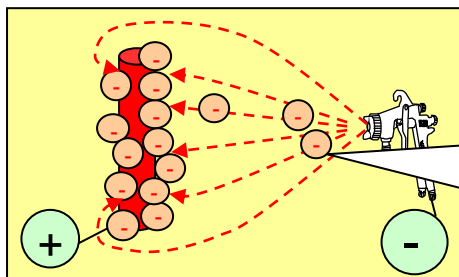


Technical knowledge of color deviation and mottling

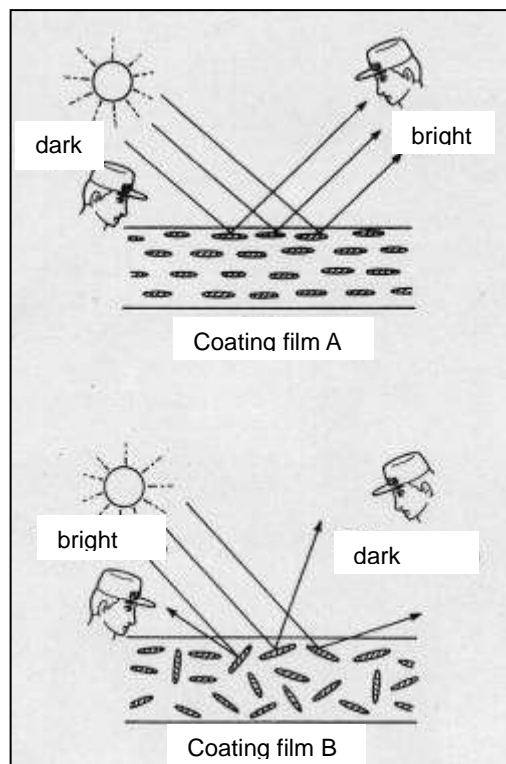
- 1: Body painting: paint for high-temperature drying
Bumper (plastic) painting: paint for low-temperature drying
- 2: Electrostatic painting: Paint is atomized by air etc. and paint particle is charged through high voltage application. Then, the paint can be attached to the earthed body efficiently.

<Principle>

This is based on the characteristics that + (positive) and - (negative) electricity attract each other while positive-positive or negative-negative electricity repel each other. Applied paint has a negative electric charge with a high-voltage generator, while body has a positive electric charge since it's earthed. Accordingly, paint is drawn to the body and attached.



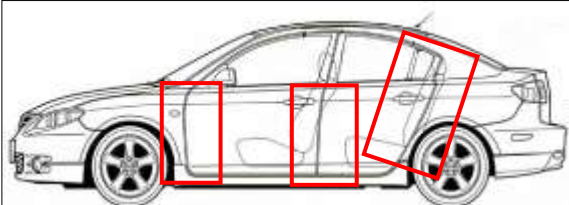
As the electrode of the painting machine releases negative electrons and charges the paint, the paint is drawn to the positive side and attached more efficiently.



3: Metallic paint color changes because configuration of aluminum pieces in the paint is changed depending on the paint conditions such as thinner amount and sprayed air pressure etc. As the aluminum pieces in the paint are reflected under light, they work much like a mirror. As shown in the right picture, if there're coat A with aluminum pieces evenly arranged and coat B with irregularly-arranged aluminum pieces, coat A with fine aluminum piece arrangement looks bright from the direction where the light enters the eye (direct lighting condition) because aluminum pieces are reflected more. However, it looks dark from the direction where the light doesn't enter the eye (back lighting) as aluminum pieces are rarely reflected. As for coat B with irregularly-arranged aluminum pieces, it looks darker than coat A under direct lighting condition because there are less reflection than coat A. But as there's reflection under back lighting condition to some extent, it looks brighter than coat A.

Additional technical knowledge of overspray

Mazda's production plant is producing multiple models with multiple colors. Therefore, painting capability of the automatic paint machine wasn't sufficient in the past due to produced models' shapes, sizes and a line speed (because the machine painting process must be finished before the rear of the preceding vehicle is painted completely so that the paint of the automatic paint machine can be replaced with the color for the following vehicle on time.) So, the rear area of the vehicle was additionally painted by an operator and surfaces of the side area (such as fender, door edge etc.) were over sprayed by the manual painting, increasing the paint thickness partially.



During inner spraying, paint was sometimes attached to the surface due to overspray.

Due to small interval to the next vehicle, automatic painting couldn't be finished on time and it was painted manually.



At present, Mazda's production plant has introduced 3 wet-on paint system, replaced the automatic paint machine with the automatic paint robot, and modified the conventional conveyor line to the shuttle line (Painting finished one by one) to apply paint with all-surface automatic machine. So, it's less likely to have this symptom now. However, for the areas where automatic paint robot cannot apply the paint, additional spray is being applied by an operator.

(3) Introduction of 3 wet-on paint



3 wet-on paint is the technology developed by Mazda before the rest of the world, having started to be introduced from Hofu plant since July, 2002. In the painting process, where the largest amount of energy is spent in the overall vehicle production process, this technology allows 3 layers including middle coat, top coat, and clear coat to be painted consecutively and then dried up all at once. Thanks to this technology, energy consumption has been reduced by 15%. In addition, we have been able to reduce the usage of VOC (Volatile Organic Compound) by 45% compared to the conventional process.

- Feb. 2004 1st Prize for Promoting Machine Industry/Economy, trade and industry minister's prize (Japan Society for Promotion of Machine Industry)
- Mar. 2004 50th Okochi Memorial Foundation "Okochi manufacturing prize" (Okochi Memorial Foundation)
- Nov. 2004 Minister of the Environment's FY 2004 commendation for global warming prevention activity "Technology development and commercialization section" (Ministry of Environment)