



About silica-based coating(EMMARINI'S) on aluminum alloy

It is a new aluminum surface treatment technology that replaces anodizing and fluoride resin coatings.

(Japanese Patent 74269029)"

The Problems of Fluoride Resin Coatings

(They are non-stick, however)

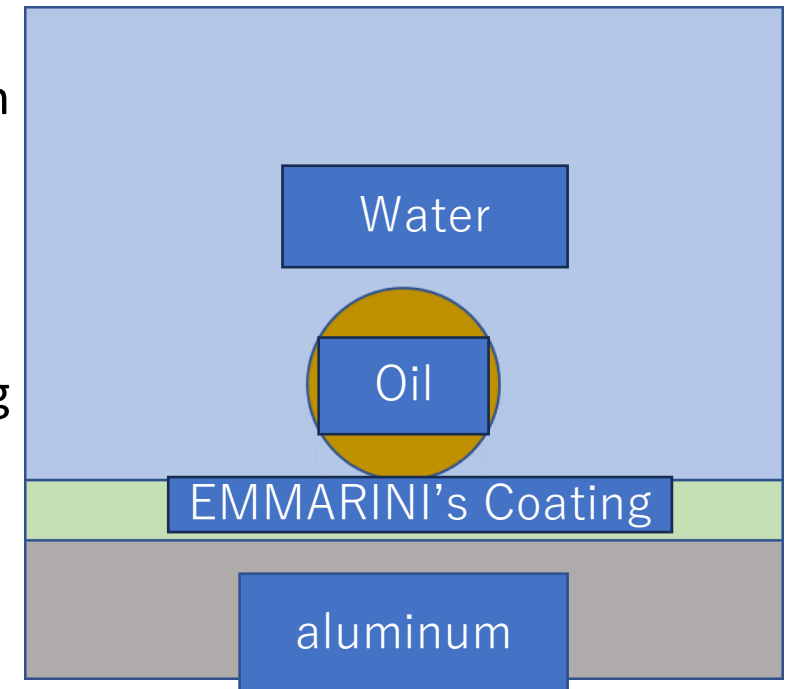
- They decompose at temperatures above 260° C, so it is not suitable for high-temperature, strong-fire cooking (you cannot fully enjoy the texture in stir-fries or grilled dishes).
- Toxic gas is generated at temperatures above 350° C (cannot be incinerated) . Please be careful with the handling of such materials. Safety first!
- They safely decompose in a cement kiln (1500° C), but fluorine (halogen) ions corrode the rebars in concrete.
- Since it is difficult to decompose with chemicals, recycling is difficult.
- In the end, They end up being disposed of in landfills, but if it leaks into the ocean, it will float indefinitely. Fluoropolymer is a convenient material, but it leaves a troublesome debt-like material for future generations. Environmentally friendly anodized coatings (alumina) and silica are suitable for SGDs.

Comparison among the EMMARINI's (SiO₂ system), Fluoride resin, anodizing, current ceramics coatings , and non-coating aluminum alloy

Item	EMMARINI' s	Fluoride	Anodizing	Ceramics	Aluminun
Heat resist	4 0 0 °C	2 6 0 °C	1 5 0 °C	4 0 0 °C	4 0 0 °C
Heat shock resist	Good(<1 μ)	Bad(>10μ<)	Bad(>10μ)	Bad(>10μ)	Good
Non-stick	Need Preheat	Good	Bad	Need Preheat	Bad
Scratch resist	Good	Bad	Good	Good	Good
Pencid hardness	6~9H	F~H	H	6~9H	2 B
Heat conduct	Good	Bad	Middle	Middle	Good
Color	Dying Black	Pigments	Dying	Pigments	No
Cleanability	Good by hydrophilic	Good by hydrophobic	Middle	Good by hydrophilic	Bad
Corrosion resist	Good	Good	Weak to alkali	Good	Bad
Environment friend	Good	Bad	Good	Good	Good

Especial Difference Between EMMARINI's and Anodizing

- 1. EMMARINI's Coating:** EMMARINI's is a transparent silica-based coating that can take advantage of the metallic luster in design. (Anodizing is cloudy)
- 2. Thickness and Heat Resistance:** The film thickness is less than 1μ , and it has excellent heat resistance and thermal shock resistance. It can also be used at high temperatures like a frying pan. (Anodizing has a film thickness of more than 10 microns and is only for pots and kettles to boil)
- 3. Heat and Alkali Resistance:** It has excellent heat resistance and is more alkali-resistant than the base material. (Anodizing is weak to alkali)
- 4. Hardness and Scratch Resistance:** The pencil hardness is up to 9H, and it is more scratch-resistant than the base material. (usually 2H)
- 5. Hydrophilicity and Cleanliness:** It shows hydrophilicity, and dirt is easy to remove. (Anodizing is better at removing oil stains), see drawing



Application Sample to Aluminum Frying-pan

(<https://emmarini.com>)

- 1. Stencil Technique:** Mask with the stencil technique and apply the coating solution.
- 2. Masking Removal:** Remove the masking and heat cure the coating at 250-300° C
- 3. Dye Black:** When tap water is boiled, the non-coated part turns black, and the drawing appears.
- 4. Drawing Protection:** If you coat the entire area including the blackened part, the drawing will be protected and fixed



Cooking with EMMARINI' s

- 1. High-Temperature Cooking:** It can be cooked at high temperatures up to 300°C. In tests, even when baked at 400°C, there were no abnormalities in the coating, but the frying pan becomes soft due to annealing.
- 2. Leidenfrost Effect:** With preheating above 250°C, the Leidenfrost effect makes it difficult for food to stick. Furthermore, the surface OH groups that show hydrophilicity evaporate, making it water-repellent. If you apply oil, it will become even less sticky.
- 3. Delicious Food:** High-temperature stir-frying and the crispy sear on meat make it delicious. High heat is only necessary at the beginning, and it won't stick even if you lower the heat afterwards. You can't experience this texture with fluoride resin, which only conducts low heat.
- 4. Easy Cleaning:** It's easy to clean because dirt comes off with just water. Even if it sticks, it can be cleaned with melamine foam. This is because the OH groups revive at low temperatures.
- 5. Burn Removal:** Even severe burns become soft and easy to peel off when you boil water in it.
- 6. Detergent Use:** Acidic and alkaline detergents can be used at room temperature.
- 7. Coating Comparison:** The group of photos on the right compares the top half that has been coated.

Top half is treated.



Non-oil omelet



Non oil Ragu



Wash with water



Black burn cleaning

EMMARINI's is effective also to the outside stain cleaning. Inside stain is easy to clean by boiling water, but outside was hard, but...



Before the cleaning of outside



After the cleaning with bleach for one night pack

“Kitchen bleach is a mixture of alkali, Cl₂ and detergent and is quite effective for cleaning hard burnt oil, but it can only be applied to ceramics. It cannot be used on iron, stainless steel, aluminum, etc., because it corrodes the metal. EMMARINI's protects the surface from the alkali attack,

Notes

- **Avoid Abrasives:** Please refrain from using sponges with abrasives, steel wool, metal spatulas, and other abrasives as they can damage the surface. For maintenance, please use tools designed for fluoride resin processing. However, melamine foam is recommended.
- **Cleaning Agents:** Please refrain from using strong acidic or alkaline cleaning agents. Weak alkaline cleaning agents like citric acid, bleach, and baking soda can be used regularly, but please refrain from using them at high temperatures.
- **Acidic Foods:** Please refrain from cooking extremely acidic foods (pH2 or below) like undiluted vinegar or lemon juice. Please dilute them to 10 times (>pH3) or more.
- **Tomatoes:** Tomatoes (pH4) can be cooked and stored.
- **High-Temperature Cooking:** To prevent black burning during high-temperature cooking, please adjust the heat appropriately after adding the ingredients.

Coating Method

Process: Degreasing → Deposition → Heat curing

- 1. Degreasing:** Degreasing is done with alkali, acid cleaning agent, abrasive, air baking, etc., until there is no water repellency.
- 2. Deposition:** Black dyeing is done before coating if necessary. The coating liquid is adjusted by adding and mixing a separately sold surfactant (for smoothness improvement) and ion-exchanged water (considering workability) as necessary. Coating can be done by roller, wiping, spraying, dipping, and especially dipping is easy and improves smoothness. We can introduce paint manufacturers. The recommended film thickness after baking is 0.5 to 1.0 μ .
- 3. Curing:** The recommended curing conditions are a physical temperature (not atmospheric temperature) of 250°C for 10 minutes or more. Shorter time is possible at higher temperatures. The minimum is 150°C for 10 minutes, and under this condition, it will not dissolve in room temperature water. The higher the baking temperature, the better the water resistance, and the lower the temperature, the better the hydrophilicity. Please consider according to your specifications. Baking at 250°C or higher is necessary for obtaining boiling water resistance, acid and alkali resistance as a frying pan.