Jicolour

Jikan Nanostructured Paint and Coating

Superhydrophobic paint | Catalogue 2021-2022

OUR HISTORY

Surface Nano engineering (SNE) research center was founded in 2014 by performing different projects related to surface nano-engineering with applications on metals. Later, development of superhydrophobic, superhydrophilic, anit-corrosion, silicone, and icephobic coatings were added.

After 2 years of active research and development on nano-enabled coatings, in 2016, a team at SNE research center was formed to domesticate the equipment relevant to nanotechnology, specifically surface nano-engineering equipment. In late 2016 Jikan Surface Nano-Engineering Co. was founded to commercialize the developed devices.

As of right now, Jikan surface nano-engineering company is one of the leading companies in west Asia active in manufacturing laboratorial and industrial equipment relevant to nanotechnology. Different classes of Jikan contact angle machines are used by different researchers to measure the static/dynamic contact angle, surface tension of liquids and surface free energy of solids. Jikan ice adhesion test machine is the first of its kind for measuring the adhesion between ice and surfaces and is used by researchers in industry and academia to evaluate the icephobic coatings.

In 2020 researchers at SNE research center were succeeded to formulate a superhydrophobic paint for the first time in the Asia. In the past, different superhydrophobic coatings were developed at the center, but formulating a superhydrophobic paint is way more difficult due to the following reasons. A coating is usually formulated to remain for a couple of weeks on the surface, whereas a paint should properly adhere to its substrate and last for at least a couple of years. Also, despite coatings, paints come in different colors.

In late 2020, Jikan nanostructured Paint and Coating Co. was founded to commercialize the superhydrophobic paints under Jicolour trademark. This company is one of the few companies in the world producing superhydrophobic paints.

Our transparent superhydrophobic and silicone coatings are being developed and produced in Jikan Polymers and Silicones Co.

Jikan nanostructured
paint and coating

Catalogue 2021-2022

Superhydrophobic paint for facade

Jicolour is a superhydrophobic paint developed by JikanGroup.
Note "Superhydrophobic paint" and not "hydrophobic paint"
nor "superhydrophobic coating".

The Jicolour exterior paint is applicable to exterior walls, e.g. cement, concrete, brick. The Jicolour paint repels moist, acid, base, dirt, dust and smoke. The painted surface remains clean for at least 5 years and throughout this time, looks fresh. This paint has all of the required properties of a top-notch paint (e.g. UV, chemical and physical durability) plus superhydrophobicity. The Jicolour paint comes in different colors and can be applied using roller, brush or spray.

| Superhydrophobicity in accordance with ISO 19403	Fast drying time according to ASTM D 1640	Durability according to ISO 11998 and ISO 16474

How superhydrophobicity keeps surfaces clean?

The first generation of paints were mostly hydrophilic. On surfaces painted with such paints (i.e. typical paints), water droplets pick up the dirt but they cannot easily move and eventualy evaporate. When the drops evaporate, the residues remains on the surface results in surface fouling (Fig. 1), some call this fouling mechanism "coffee-stain": due to similarities to evaporation of coffee drops on surfaces.

After many years, the second generation of paints were introduced: Hydrophobic paints. Surfaces painted with hydrophobic paints, are slightly better than those painted with regular paints, but not comparable with superhydrophobic paints (Fig. 2). Lower adhesion of water droplets on these surfaces makes them washable which means waterjet removes resonable part of adhered dirts. Most of the paints in the market known as nano paints are in this class.

Latest generation of paints are superhydrophobic paints. Water droplets bead up on superhydrophobic paints and easily roll-off without penetrating into the nano features. The scientific term for this wetting state is "Cassie-Baxter". As drops roll-off on the surface, they gather dirt and leave the surface clean (Fig. 3).
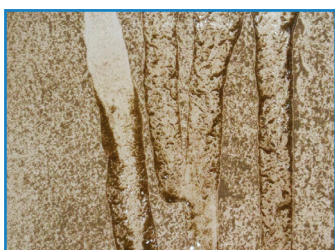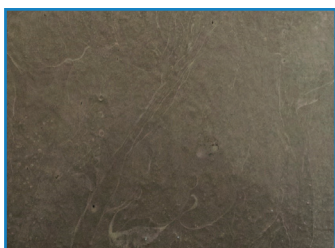

Fig 1. Typical paint (1st gen.)
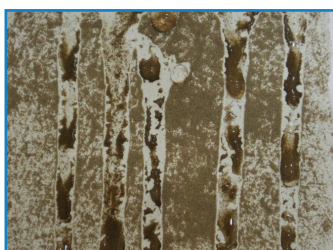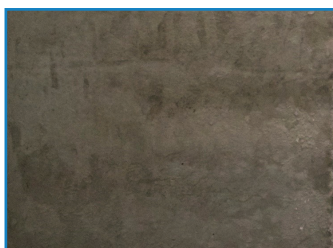
Fig 2. Hydrophobic paint (2nd gen.)
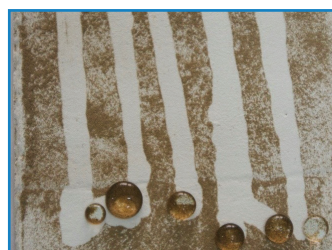
Fig 3. Jicolour superhydrophobic paint (3rd gen.)

Surfaces painted with Jicolour superhydrophobic paint are resilient to dust and smoke and smallest air or water stream can repel the dust and smoke particles. Figures 4 to 6 compare the typical, hydrophobic and superhydrophobic paints exposed to smoke for 4 h followed by exposure to free air/water stream.

Fig 4. Typical paint (1st gen.)

Fig 5. Hydrophobic paint (2nd gen.)

Fig 6. Jicolour superhydrophobic paint (3rd gen.)

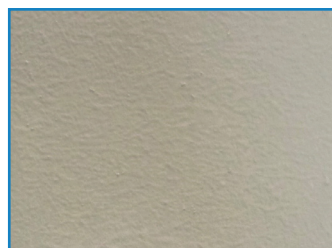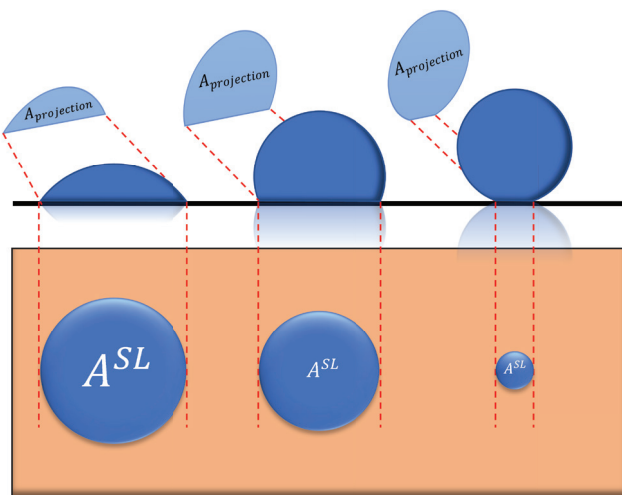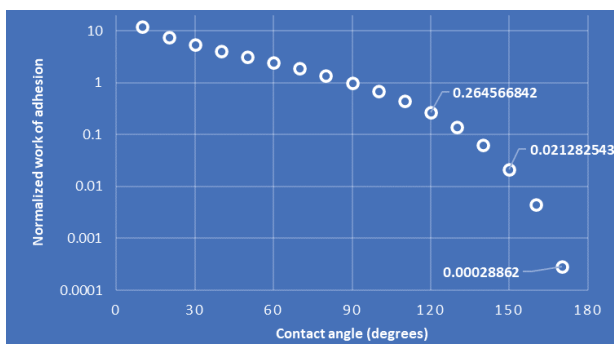# Contact angle, key factor in self-cleaning properties

1

Typical paints are mostly hydrophilic which means the contact angle is below 90°. Smaller contact angle results in larger work of adhesion (the energy required to detach the drop from its substrate). So, the droplet has more time to collect dust and oil from surrounding and when evaporates, it leaves the surface dirty.

2

Hydrophobic paints have low surface free energy which results in higher contact angles (compared to typical paints), and facilitates the droplet rolling. As such, these paints can delay the fouling. However, by reducing the surface free energy, the maximum contact angle one may attain is about 120°. As such, the contact angle of water drops on hydrophobic paints is at most 120°.

3

Thanks to the nanotechnology, in recent years, manufacturing the nano features has come into reality. With such features, contact angles as large as 150° and contact angle hysteresis as low as 10° can be attained. Because of the small interface, water droplets easily roll-off on such paints. As such the painted surface remains clean and achieves self-cleaning property.

69.1	74.9
105.3	91.4
162.1	168.4

θ (degrees)	120°	150°	160°	170°
Self-cleaning compared to θ=90°	5.7X↑	97X↑	499X↑	8041X↑

θ (degrees)	120°	150°	170°
Attachment compared to θ=90°	4X↓	47X↓	3465X↓
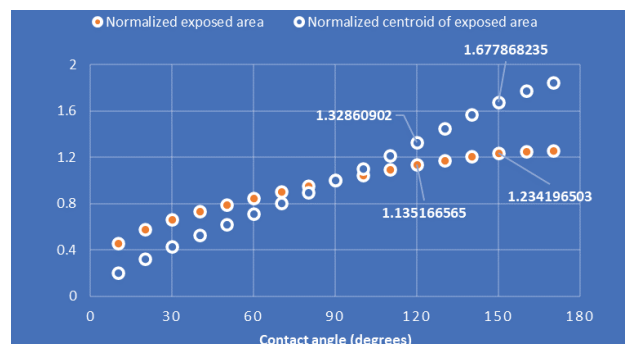
θ (degrees)	120°	150°	170°
Shedding sensibility compared to θ=90°	1.4X↑	2.1X↑	2.3X↑

Work of adhesion and sheddability both contribute to self-cleaning property. Work of adhesion is the work/energy required to detach a drop from its substrate, i.e. $W_A = \gamma^{LV} A^{SL}(1+\cos\theta)$. And sheddability shows how strong wind is sensed by the drop.

Sheddability is function of droplet surface area (projected surface area) and the droplet centroid height. Both sheddability and work of adhesion are contact angle dependent. By increasing the contact angle from 90° to 120°, 150°, and 170°, the self-cleaning property increases by 5.7, 97 and 8041 folds, accordingly.

Contact angle of Jicolour superhydrophobic paint is 160°, as such, its self-cleaning property is 499 times better than hydrophobic paints and 87 times better than the best hydrophobic surface (Teflon surface).

Nanostructures on Jicolour superhydrophobic paints

critical factor to reach contact angle larger than 160°

Although, surface chemistry is an important factor affecting the contact angle, for creating superhydrophobic surfaces, surface morphology should be modified. Nano asperities along with low surface results trapped energy air inside surface asperities and hinders the penetration of water droplets inside nano structures. Note that there is no nanofeature present on hydrophilic and hydrophobic paints.

In summary, these nano features are responsible for superhydrophobicity and self-cleaning properties. Surface morphology of a substrate painted with Jicolour superhydrophobic paint with 50,000X magnification is shown in Fig 7. Figs 8 to 10 compare the surface asperities of regular and hydrophobic paints with Jicolour superhydrophobic paint (200,000X magnification).
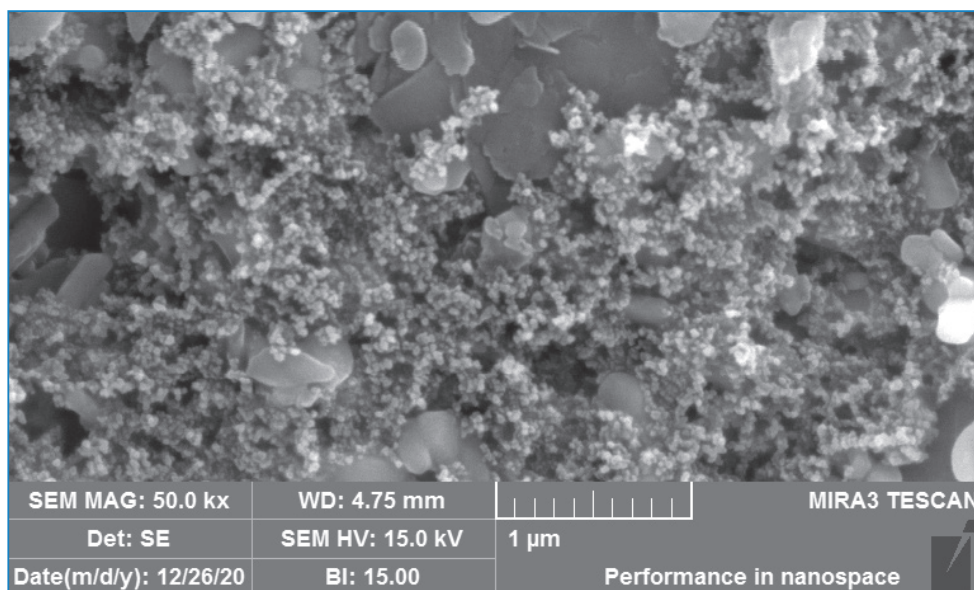

SEM MAG: 50.0 kx	WD: 4.75 mm		MIRA3 TESCAN
Det: SE	SEM HV: 15.0 kV	1 μm	
Date(m/d/y): 12/26/20	BI: 15.00		Performance in nanospace

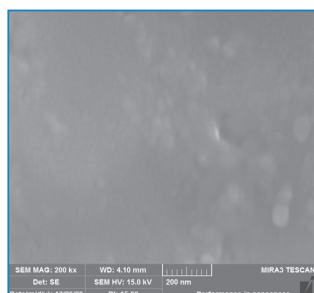Fig 7. Jicolour Superhydrophobic Paint with magnification of **50 kX**

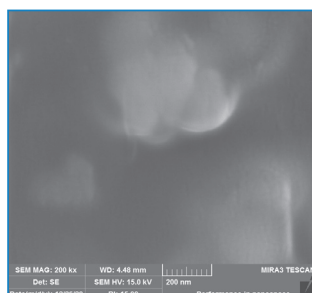Fig 8. Typical Paint with magnification of **200 kX**

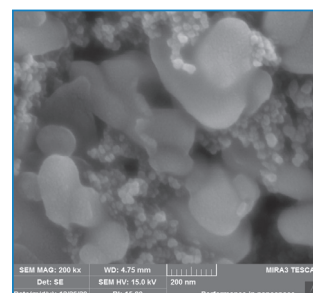Fig 9. Hydrophobic Paint with magnification of **200 kX**

Fig 10. Jicolour Superhydrophobic Paint with magnification of **200 kX**

Difference between
Superhydrophobic Coatings
and
Superhydrophobic Paints

Due to excellent properties of superhydrophobic surfaces, in recent years, different companies have marketed superhydrophobic coatings. The main drawback of superhydrophobic coatings is their weak bonding to their substrates. Superhydrophobic coatings usually last for only a couple of weeks. Despite superhydophobic coatings, superhydrophobic paints create a strong bonding with their substrates. As such, superhydrophobic paints keep their properties for years. Only a few companies seem to have the know-how of producing superhydrophobic paints. The Jicolour by JikanGroup is the only superhydrophobic paint producer in Asia.

	Nano features	Low surface energy	Strong bonding to the substrate
Superhydrophobc paint	✔	✔	✔
Hydrophobic paint	✘	✔	✔
Superhydrophobic coating	✔	✔	✘

How to apply

✔ The surface to be painted should be clean and dry.
✔ Coverage is 4 m² per kg paint and may be improved using the recommended primer. Using other primers may affect the paint quality. The primer is water-based and can be thinned with water if required.
✔ Before applying the paint, make sure the primer is dry (usually after 24 hrs). For the best results, let the Jicolour paint dry for 24 hrs.
✔ The Jicolour superhydrophobic paint is a solvent-based paint and may be thinned using the recommended solvent. Make sure not to add more than 160 cc solvent per kg paint.

Safety

If the paint contacts the eyes, promptly flush the eyes for at least 15 min.
Keep the paint in cool and dry place.

"

Save money by spend

پول خود را ذخیره کنید!

For Superhydrophobic Paint

Primer	پرایمر رنگ فوق آب‌گریز ژیکالر

For Superhydrophobic Paint

Solvent	حلال رنگ فوق آب‌گریز ژیکالر

For Superhydrophobic Paint

Primer	پرایمر رنگ فوق آب‌گریز ژیکالر

با خرج کردن در راه درست

Superhydrophobic Paint

رنگ فوق آب‌گریز ژیکالر

Superhydrophobic Paint

رنگ فوق آب‌گریز ژیکالر