

# MODIPER<sup>®</sup> F-FS series

## Technical Data Sheets

 **NOF CORPORATION**

## 1 About MODIPER® F, FS series

**MODIPER® F, FS series** is an innovative type block copolymer, which contains “Fluorinated segment” or “Silicone segment” as shown by Figure 1 and Table 1, which is exclusively manufactured by NOF CORPORATION utilizing NOF’s developed block polymer technology.

The other features are as follows,

- **MODIPER® F, FS series** can improve surface properties of water repellency, anti-pollution property, anti-frictional property, tack strength control property and anti-cohesion property of acrylic coating materials and resins by the addition 1~3%.
- **MODIPER® F, FS series** can be dissolved into various organic solvents and dispersable into acrylic polymers, and synthetic resins.
- **MODIPER® F series** can improve dispersant property for PTFE powder.
- **MODIPER® F series** do not contain PFOA (Perfluorooctanoic acid) defined as one of environmental concern materials.
- **MODIPER® FS series** do not affect the stability and thermal properties of base coating.

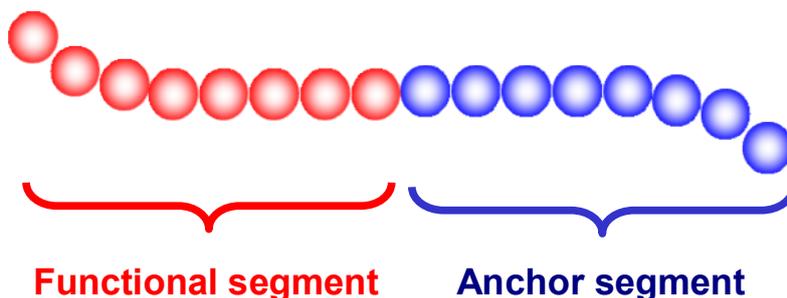


Figure 1. Structure of MODIPER® F, FS series

Table 1. About of MODIPER® F, FS series

Product name	Functional segment	Anchor segment	Shape
MODIPER® F606	Fluorinated copolymer	Acrylic copolymer	White powder
MODIPER® FS700	Silicone copolymer	Acrylic copolymer	White powder

## 2 Basic Properties of MODIPER® F series

Table 2. Water repellency and thermal properties of MODIPER® F, FS series

Test item		Test method	Unit	F606	FS700
SCA <sup>1)</sup>	Water	JIS <sup>3)</sup> R 3257 (1999)	degree	110	105
	n-hexadecane			75	10
TGA <sup>2)</sup>	1% weight loss temperature	JIS <sup>3)</sup> K 7120 (1987)	°C	170	170
	5% weight loss temperature			250	190

1) Static Contact Angle :

Glass plate coated with MODIPER® F606 (dissolved in MEK, solid content: 10wt.%, dry condition: 23°C × 24h) or FS700 (dissolved in MEK, solid content: 20wt.%, dry condition: 23°C × 24h)

2) Thermo Gravimetric Analysis :

Rate of temperature rise: 10°C /min (in a nitrogen atmosphere)

3) JIS: Japan Industrial Standard

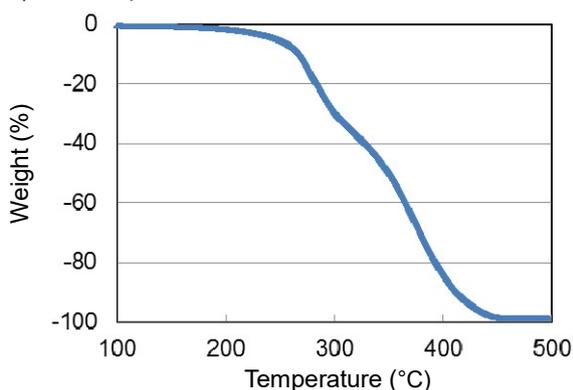


Figure 2. TGA curve of MODIPER® F606.

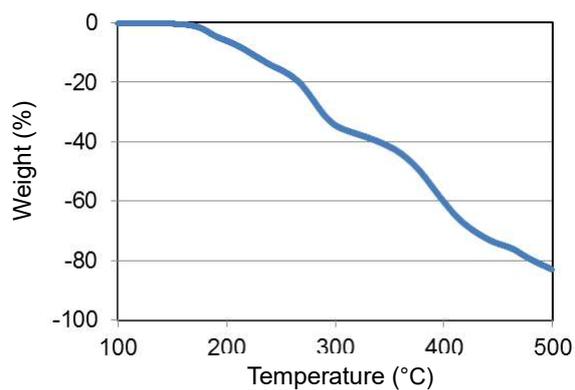


Figure 3. TGA curve of MODIPER® FS700.

### About static contact angle

The static contact angle is the angle at the interface where liquid, air and solid meet, and it quantifies the wettability of a solid surface by a liquid. High contact angle values trend to repel liquid, whereas low contact angle values show a tendency for liquid to spread and adhere to the surface.

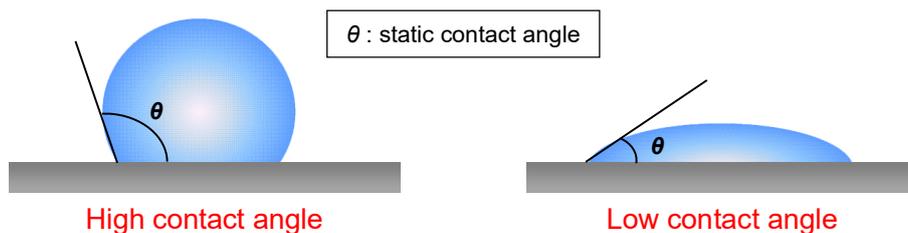


Figure 4. Image of static contact angle

### 3 Solubility of MODIPER® F,FS series

Table 3. Solubility of MODIPER® F, FS series

Solvent* or Reactive Diluent**	MODIPER® F606	MODIPER® FS700
Acetone	○	○
Methyl Ethyl Ketone	○	○
Methyl Iso-butyl Ketone	○	○
Ethyl Acetate	○	○
Butyl Acetate	○	○
Tetrahydrofuran	○	○
Ethylene Glycol Monomethyl Ether	○	○
Ethylene Glycol Monoethyl Ether	○	○
Methanol	×	×
Ethanol	△	△
n-Butanol	×	×
n-Hexane	×	×
Toluene	×	○
Xylene	×	×
Dimethylformamide	○	○
Chloroform	○	○
2-Hydroxy Ethyl Acrylate	○	△
Tetra Hydro Furfuryl Acrylate	○	△
4-Vinyl Pyridine	○	△
2-Ethyl Hexyl Acrylate	×	×
2-Hydroxy Ethyl Methacrylate	○	△
Hydroxy Propyl Methacrylate	○	—
Glycidyl Methacrylate	○	△
Neopentyl Glycol Diacrylate	○	△
Hexanediol Diacrylate	○	△
Trimethylol Propane Triacrylate	○	—

\* Solubility was evaluated by diluting to 1wt.% for each solvent.

\*\* Solubility was evaluated by diluting to 20wt.% for each reactive diluent.

○ :Soluble, △ :Partly soluble, × : Insoluble, — : Not measured

## 4 Application of MODIPER® F606 for repellency cloth

The water and oil repellency of polyester cloth coated with MODIPER® F606 was tested. As shown below Figure 5 and Table 4. MODIPER® F606 can improve the water and oil repellency of the cloth coated.

### ■ Samples

- Solvent .....: Methyl Ethyl Ketone
- Coating method .....: Dipping
- Processing cloth .....: Polyester
- Drying condition.....: 23°C×24h

### ■ Evaluation method: water repellency: JIS L 1092, Oil repellency: AATCC

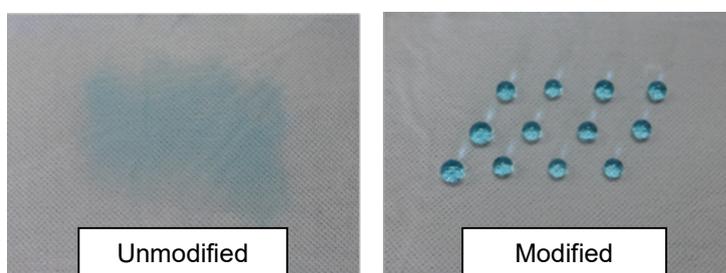


Figure 5. Water repellency of unmodified cloth and modified cloth

Table 4. Water and oil repellency of MODIPER® F606

Additive amount (wt. %)	Water repellency (points)	Oil repellency (points)
0	0	0
1	100	5

Table 5. Reference of assessment of Spray experiment (JIS L 1092)

Water repellency (points)	Reference of assessment
100	no wet ,no waterdrop on surface
50	wholly wet on surface
0	wholly wet on both faces

Table 6. Reference of assessment of Oil repellency

Oil repellency (points)	Reference of assessment and Standard reagent
8	no permeation against n-heptane
5	no permeation against n-dodecane
1	no permeation against Nujol
0	permeation by Nujol

## 5 Application of MODIPER® FS700 for adhesion control

By adding MODIPER® FS700 into acrylic coating material, it can control the adhesion with lower migration of silicone-related substance to adhesive surface than conventional silicone oil (Figure 6).

The acrylic segment in MODIPER® FS700 can work as the anchor for base acrylic coating and it can prevent from transferring the silicone-related material to the adhesive surface (Figure 7).

### ■ Evaluation method

- Base film ..... : PET(polyethylene terephthalate)
- Thickness of adhesive..... : 7 $\mu$ m
- take-up rate..... : 200mm/min

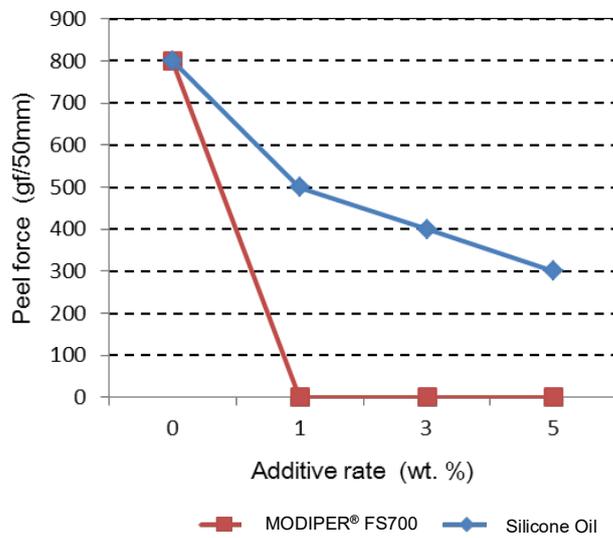


Figure 6. Peel test of adhesive compound with MODIPER® FS700

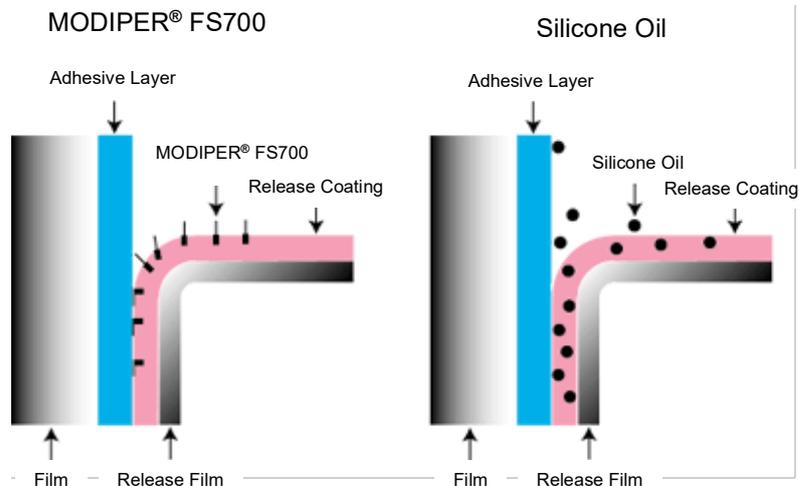


Figure 7. Mechanism of MODIPER® FS700 in acrylic coating material

## 6 Shape, Package & Storage

- Shape:
  - MODIPER® F606 ..... : White powder
  - MODIPER® FS700..... : White powder
- Package:
  - MODIPER® F606 ..... : 15kg in Fiber Drum
  - MODIPER® FS700..... : 15kg in Fiber Drum

**MODIPER® F, FS series** should be stored in the original packaging at a dry and cool place (less than 30°C is recommendable) without a direct sunlight.

## 7 Chemical Inventory of MODIPER® F,FS series

Table 7. Chemical Inventory of MODIPER® F, FS series<sup>1)</sup>

Product	Japan	USA	EU	China	Korea	Taiwan	Philippines
	ENCS	TSCA	REACH	IECSC	ECL	ECN	PICCS
MODIPER® F606	Listed	Not Listed	Not Listed	Not Listed (Simplified Notification <sup>2)</sup> )	Not Listed	Listed	Not Listed
MODIPER® FS700	Listed	Not Listed (Polymer Exemption)	Not Listed	Not Listed (Simplified Notification <sup>2)</sup> )	Not Listed	Listed	Not Listed

1) Please be sure to contact to us before imported to each country.

2) Confirmed as Low Concern Polymers / Registered by NOF(Shanghai) Co., Ltd.

## 8 Notes

- Although Research Department of NOF CORPORATION has compiled the figures in this catalogue, NOF CORPORATION can not guarantee the results in independent tests.
- All precautionary labels and notices should be fully read and understood by all supervisory personnel and employees before using.
- For additional safety and health information, contact NOF CORPORATION.

NOF CORPORATION does not guarantee any rights on utilizing **MODIPER® F, FS series**.

Additionally, NOF CORPORATION would encourage your company to experiment with **MODIPER® F,FS series** exceptional properties to discover your solution. Please inquire about NOF's sampling program.

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### Notes

The contents of this brochure are based on materials, information, and data available as of October 2011 when this brochure was published. However, the descriptions about data, evaluation, hazard, toxicity, and other characteristics are not proof of any guarantee. The contents describe only ordinary handling procedures for **MODIPER® F, FS series**. When using or handling such substances in special ways, adequate safety measures for the specific usage and applications are required.

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