Technical Data Seat

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.

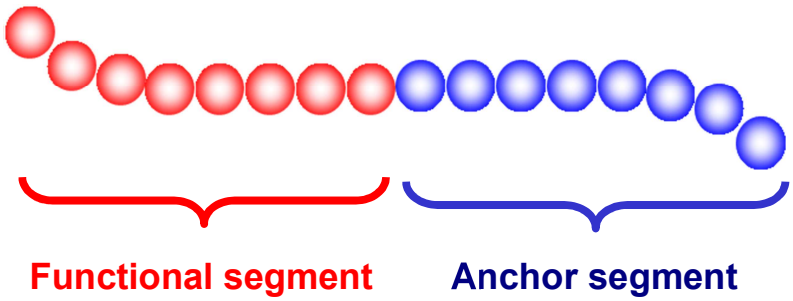

Figure 1. Structure of MODIPER™ F, FS series

Table 1. About of MODIPER® F、FS series

Product name	Functional segment	Anchor segment	color	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. Basic properties of MODIPER® F606

Test item			Test method	Unit	F606
DCA[1)]	Water	Advancing Contact Angle	JIS[3)] R 3257	degree	120
		Receding Contact Angle		degree	65
	n-hexadecane	Advancing Contact Angle	JIS R 3257	degree	70
		Receding Contact Angle		degree	33
TGA[2)]	1% weight loss temperature		JIS K 7120	℃	170
	5% weight loss temperature				250

1) Dynamic Contact Angle:
Aluminum plate coated with MODIPER® F606 (dissolved in MEK, solid content: 10wt%、dry condition: 23℃×24h)

2) Thermo Gravimetric Analysis:
Rate of temperature rise:10℃/min (in a nitrogen atmosphere)

3) JIS: Japan Industrial Standard

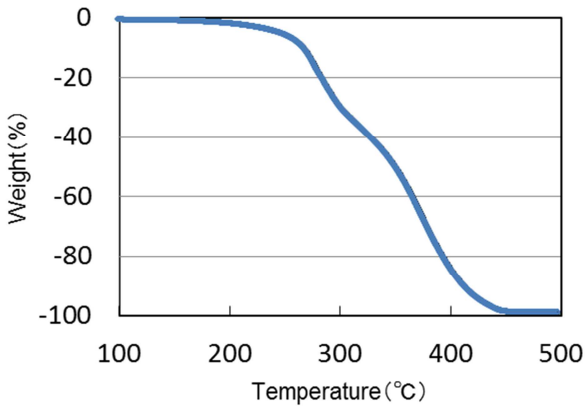

Figure 2. TG curve of MODIPER® F606.

About contact angle

Evaluation of DCA, which shows two type contact angles (Advancing contact angle (θ_a) and Receding contact angle (θ_r)). θ_a is similar to static contact angle. θ_r shows the angle on wet surface.

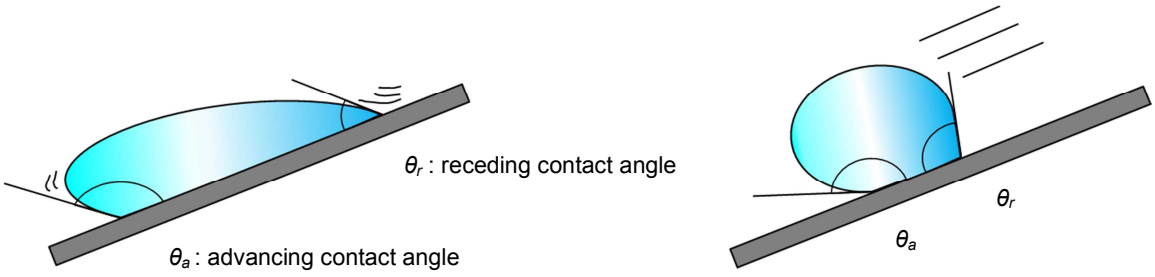

Figure 3. Advancing contact angle and receding contact angle

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	○	○
Cyclohexanone	○	○
Ethyl Acetate	○	○
Butyl Acetate	○	○
Tetrahydrofuran	○	○
Diethyl Ether	○	–
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	○	△
Neopenthyl 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

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 4 and Table 4. MODIPER™ F606 can improve the water and oil repellency properties of the cloth coated.

■ Samples
- Solvent ..... : Methyl Ethyl Ketone
- Coating method ..... : Dipping
- Processing cloth ..... : Polyester
- Drying condition..... : 23℃×24h

■ Evaluation method：water repellency：JIS L 1092、Oil repellency：AATCC

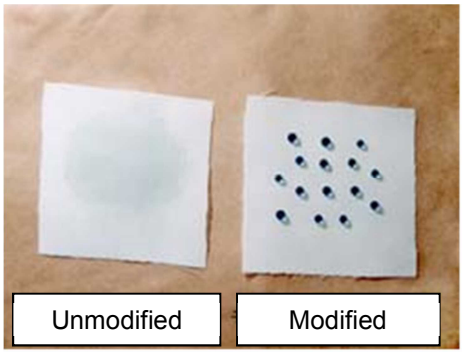

Figure 4. Modified cloth and unmodified cloth

Table 4. Water and oil repellency properties of MODIPER® F606

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

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

The 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 5).

The acrylic segment in MODIPER™ FS700 can improve as the anchor for base acrylic coating and it can prevent from transferring the silicone-related material to the adhesive surface (Figure 6).

■ Evaluation method

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

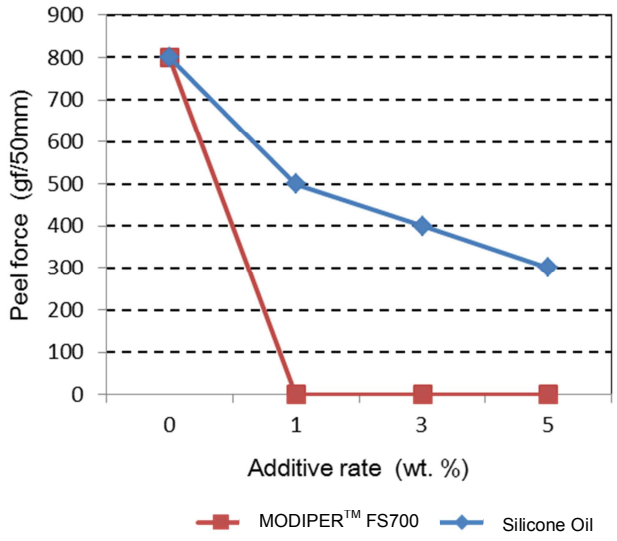

Figure 5. Peel test of adhesive compound with MODIPER® FS700

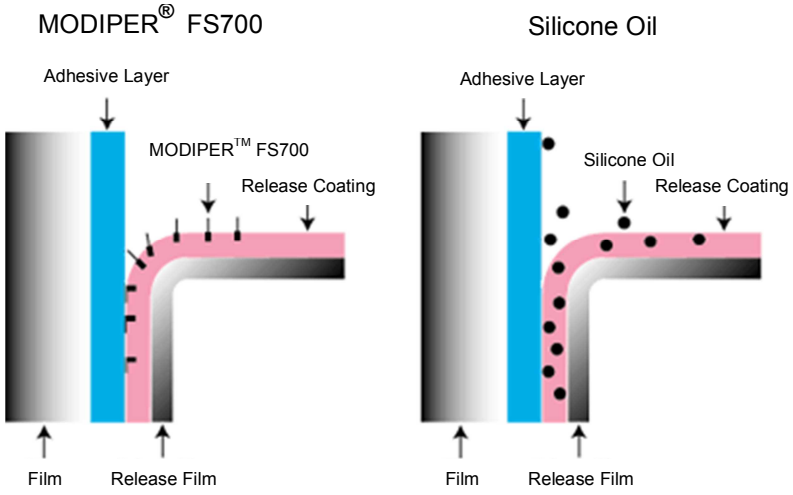

Figure 6. Mechanism of MODIPER® FS700 in acrylic coating material

6 Shape, Package & Storage

■ Shape:
- MODIPER™ F606..... : White powder
- MODIPER™ FS700..... : White powder

■ Package:
- MODIPER™ F606..... : 15kg in carton box
- MODIPER™ FS700 ..... : 5kg in carton box

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

7 Chemical Inventory of MODIPER® F,FS series

Table 7. Chemical Inventory of MODIPER® F, FS series

Product	CAS No.	Japan	USA	EU	China	Korea	Taiwan	Philippines
		ENCS	TSCA	REACH	IECSC	ECL	ECN	PICCS
MODIPER® 606	Registered (Non-disclosure)	○	×	×	○*	×	○	○
MODIPER® FS700	Registered (Non-disclosure)	○	×	×	○*	×	○	×

○:Registered、○*:Simplified registration as the polymer、×:Not registered

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.

9 Contact

NOF CORPORATION

Functional Chemicals & Polymers Div.

Yebisu Garden Place Tower
20-3, Ebisu 4-Chome, Shibuya-ku, Tokyo 150-6019 Japan
TEL : +81-3-5424-6838 FAX : +81-3-5424-6814
E-mail; modiper@nof.co.jp
URL : http://www.nof.co.jp/

NOF EUROPE GmbH

Mainzer Landstrasse 46,FBC 60325 Frankfurt am Main Germany
TEL : +49-69-7706-100-0 FAX : +49-69-7706-100-10
E-mail; info@nofeurope.com
URL : http://www.nofeurope.com/

NOF (Shanghai) Co., Ltd.

Room 2402, 24F, Huaning Plaza North Building, No.300
Xuanhua Road, Changning District, Shanghai 200050, P.R.China
TEL : +86-21-6210-1100 (Ext.102) FAX : +86-21-3208-0270
E-mail; info@nof.cn

NOF AMERICA CORPORATION

One North Broadway, Suite 912, White Plains, N.Y. 10601. U.S.A.
TEL : +1-914-681-9790 FAX : +1-914-681-9791
E-mail; info@nofamerica.com
URL : http://www.nofamerica.com/store/

■ 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.

NOF CORPORATION

Functional Chemicals & Polymers Div.

Head Office Yebisu Garden Place Tower, 20-3, Ebisu 4-Chome, Shibuya-ku, Tokyo 150-6019, Japan

TEL. +81-3-5424-6838 FAX. +81-5424-6814

E-mail: modiper@nof.co.jp URL: http://www.nof.co.jp

2nd Edition September, 2014