

Squeak noise/Tribological improver

MODIPER[®] AS100

1 About MODIPER[®] AS100

MODIPER[®] AS100 is one of polymer additives, which is exclusively manufactured by our unique technology making graft-copolymer. The features of MODIPER[®] AS100 are shown below.

- ① MODIPER[®] AS100 can reduce the risk of the squeak noise generated when it is rubbed with thermoplastic resins by adding into Polyacetal(POM), Acrylonitrile-butadiene-styrene copolymer(ABS) or Polycarbonate-ABS alloy(PC/ABS).
- ② MODIPER[®] AS100 can improve the tribological property (reduction of the abrasion loss and lower coefficient of kinetic friction) by adding into thermoplastic resins such as POM or Polyamide(PA).
- ③ MODIPER[®] AS100 is friendly for the environment in order not to contain halogenated compound.

MODIPER[®] AS100 can be used to reduce the squeak noise or to improve the tribological property for car interior (room mirror, arm rest) or copier parts (plastic gear).

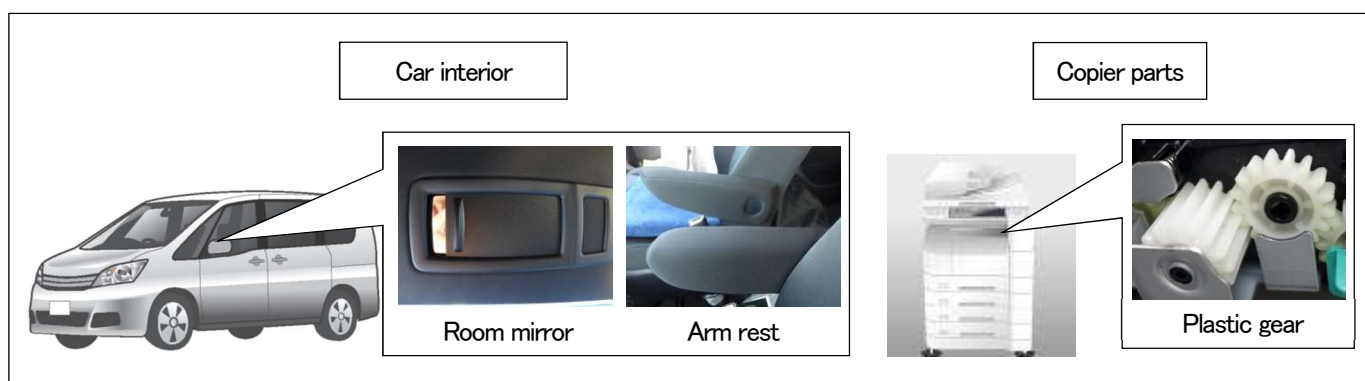


Figure 1. Application of MODIPER[®] AS100

2 Basic physical properties of MODIPER[®] AS100

Basic physical properties of MODIPER[®] AS100 are shown in Table 1.

Table 1. Basic physical properties of MODIPER[®] AS100

Product name	Mechanical property MFR ¹⁾ (g/10min)	Thermal properties		
		TGA ²⁾		DSC ³⁾
		1% weight loss temperature (°C)	5% weight loss temperature (°C)	Melting temperature (°C)
MODIPER [®] AS100	0.8	311	387	102

1)Melt Flow Rate(220°C,10kgf)

2)Thermo Gravimetric Analysis[Rate of temperature rise:10°C/min. (in a nitrogen atmosphere)]

3)Differential Scanning Calorimetry[Rate of temperature rise:10°C/min. (in a nitrogen atmosphere)]

3 Compounding and Molding condition

The compounding condition and the molding condition of **MODIPER® AS100** are shown in Table 2 and 3.

Table 2. Compounding condition of **MODIPER® AS100** with resins

Compounding method	Resin	Cylinder Temperature(°C)
Twin screw extruder	POM	150/160/170/170/180/180/190/190/190
	ABS	190/210/230/230/230/230/230/230
	PC/ABS	200/220/240/240/240/240/240/240
	PA6	200/200/210/220/230/230/240/240/240

Table 3. Molding condition of resins containing **MODIPER® AS100**

Molding method	Resin	Cylinder temperature(°C)	Mold temperature(°C)
Injection molding	POM	205	60
	ABS	240	80
	PC/ABS	250	80
	PA6	245	80

4 Evaluation method

<Evaluation of squeak noise>

① **Stick-slip test**

◆ Test equipment

Stick-slip test stand (ZIEGLER-Instruments GmbH)

◆ Evaluation condition (referred to VDA230-206: German Association of the Automotive industry)

- POM Counter material: POM Load: 10,40N Velocity: 1,4mm/s Amplitude: 20mm Reciprocation times: 3times
- ABS Counter material: ABS Load: 10,40N Velocity: 4,10mm/s Amplitude: 20mm Reciprocation times: 3times
Thermal stress condition: 80°C/300h
- PC/ABS Counter material: PC/ABS Load: 10,40N Velocity: 4,10mm/s Amplitude: 20mm Reciprocation times: 3times
Thermal stress condition: 80°C/300h

◆ Evaluation method of squeak noise

The two specimens (big and small) are prepared. Big one (Test material) is reciprocated and rubbed with small one by 3 times. The risk of squeak noise is shown by Risk-Priority-Number (RPN) which is ranked by the 10 stages shown below, in case of RPN=1~3, it is categorized as No stick-slip risk.

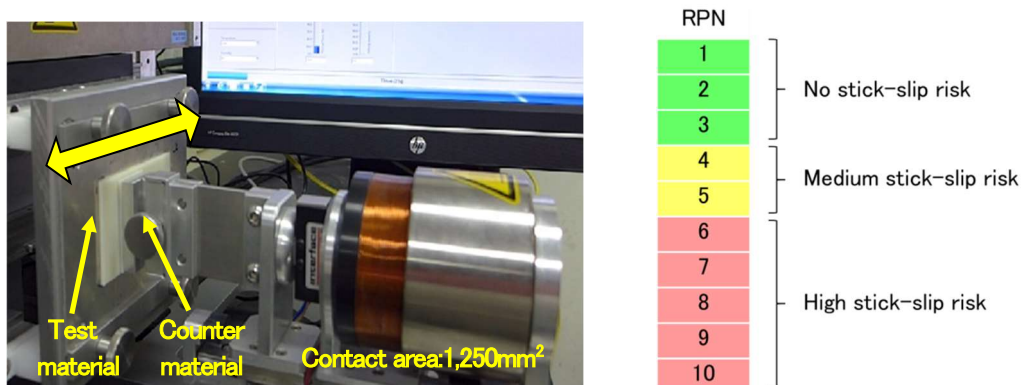


Figure 2. Stick-slip test stand

② Ring-on-ring test

- ◆ Test equipment
Friction abrasion tester (A&D Company, Limited)
- ◆ Evaluation condition (NOF's original method)

Table 4. Evaluation condition of squeak noise

Test material	Counter material	Initial load (N)	Velocity (cm/s)	Test method
POM	POM	20	10	The additional load (10N) is given with every 5 minutes.
ABS	ABS	20	1	The additional load (20N) is given with every 1 minute.
PC/ABS	PC/ABS	20	5	The additional load (10N) is given with every 5 minutes.

- ◆ Evaluation method of squeak noise

The squeak noise is evaluated by both the minimum load which the squeak noise starts to be heard by ear.

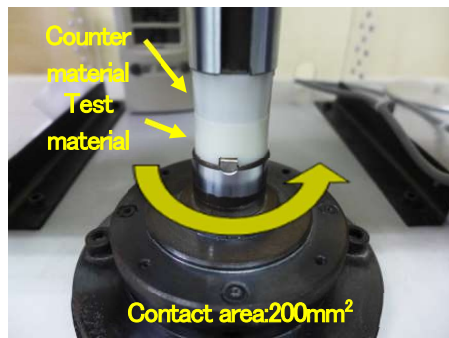


Figure 3. Friction abrasion tester

<Evaluation of tribological property>

Ring-on-ring test

- ◆ Test equipment
Friction abrasion tester (A&D Company, Limited)
- ◆ Evaluation condition (JIS K 7218)

•POM	Counter material: POM	Load: 20N	Velocity: 50cm/s	Test time: 100min.
•PA6	Counter material: Carbon steel(S45C)	Load: 50N	Velocity: 50cm/s	Test time: 100min.
- ◆ Evaluation method of tribological property

The tribological property is evaluated by both the abrasion loss derived from the weight change of the test specimen after the test and the coefficient of kinetic friction.

<Evaluation of mechanical properties>

Tensile test/Flexural test

- ◆ Test equipment
AUTOGRAPH AGS-J (SHIMADZU CORPORATION)
- ◆ Evaluation condition

•Tensile test: ISO 527-1(JIS K 7161)	Test speed: 50mm/min.
•Flexural test: ISO 178(JIS K 7171)	Test speed: 2mm/min.

Izod impact test

- ◆ Test equipment
Izod impact tester (Toyo Seiki Seisaku-sho, Ltd.)
- ◆ Evaluation condition (ISO 180/JIS K 7110)
 - Test specimen: Notched Test temperature: 23°C

5 Squeak noise prevention by MODIPER® AS100

① **POM**

By adding **MODIPER® AS100** into POM, the risk of squeak noise is reduced. In addition, **MODIPER® AS100** can make the coefficient of kinetic friction lower.

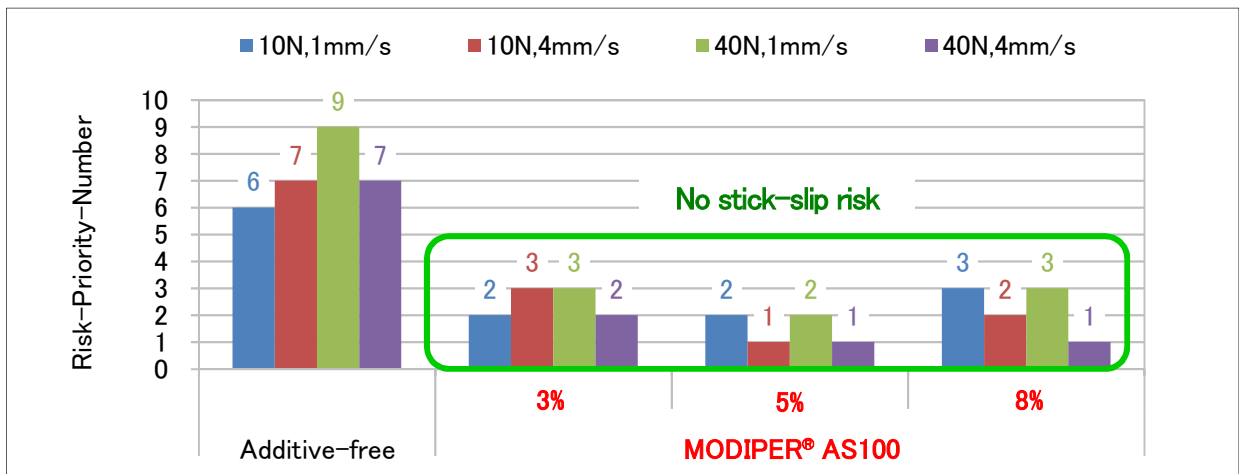


Figure 4. Evaluation of squeak noise by stick-slip test

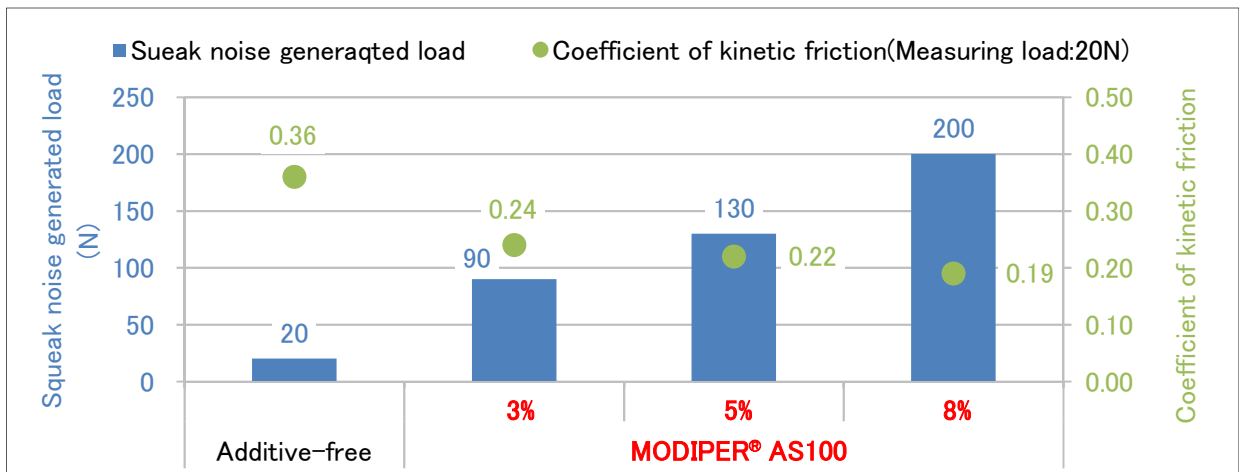


Figure 5. Evaluation of squeak noise by ring-on-ring test

② ABS

By adding MODIPER® AS100 into ABS, the risk of squeak noise is reduced after the thermal stress. In addition, MODIPER® AS100 can make the coefficient of kinetic friction lower.

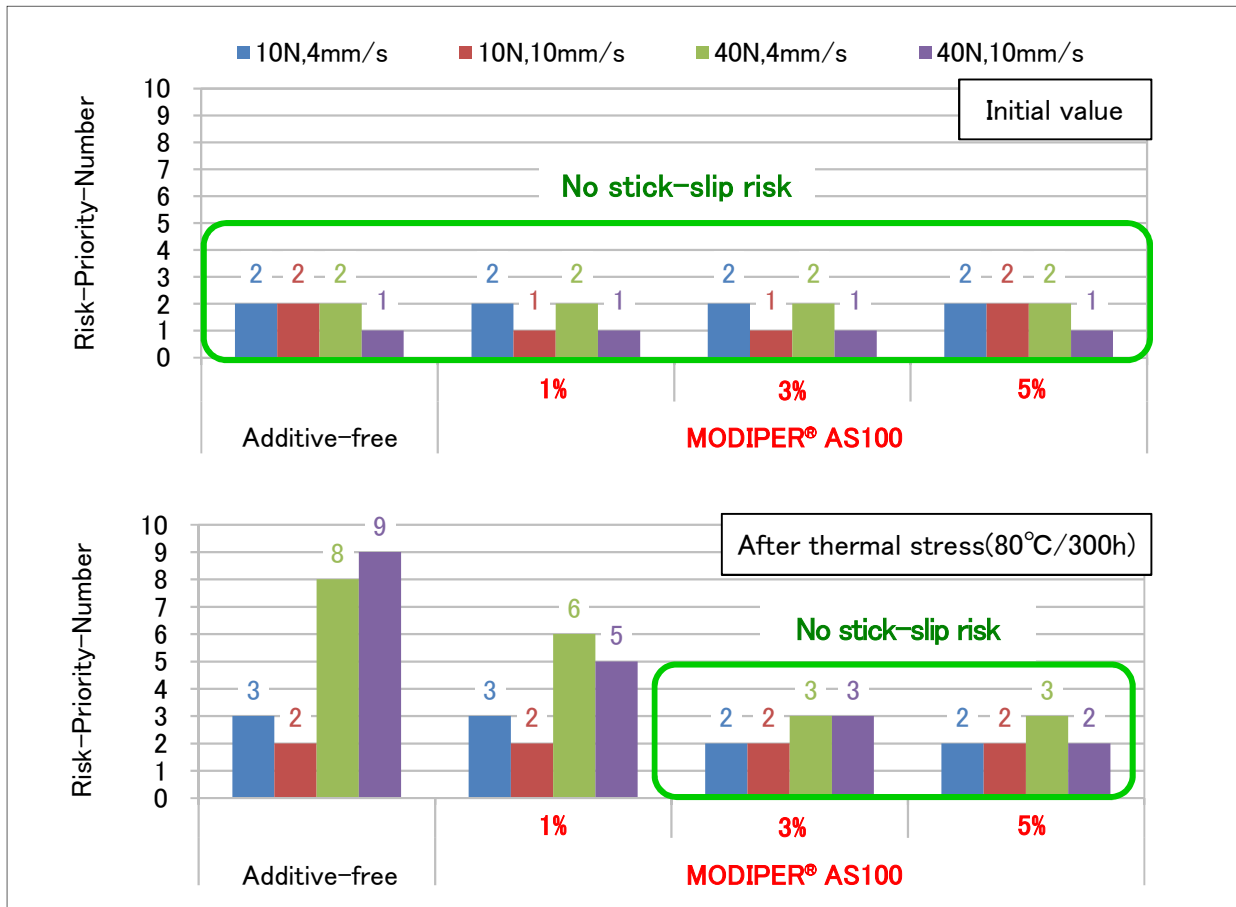


Figure 6. Evaluation of squeak noise by stick-slip test

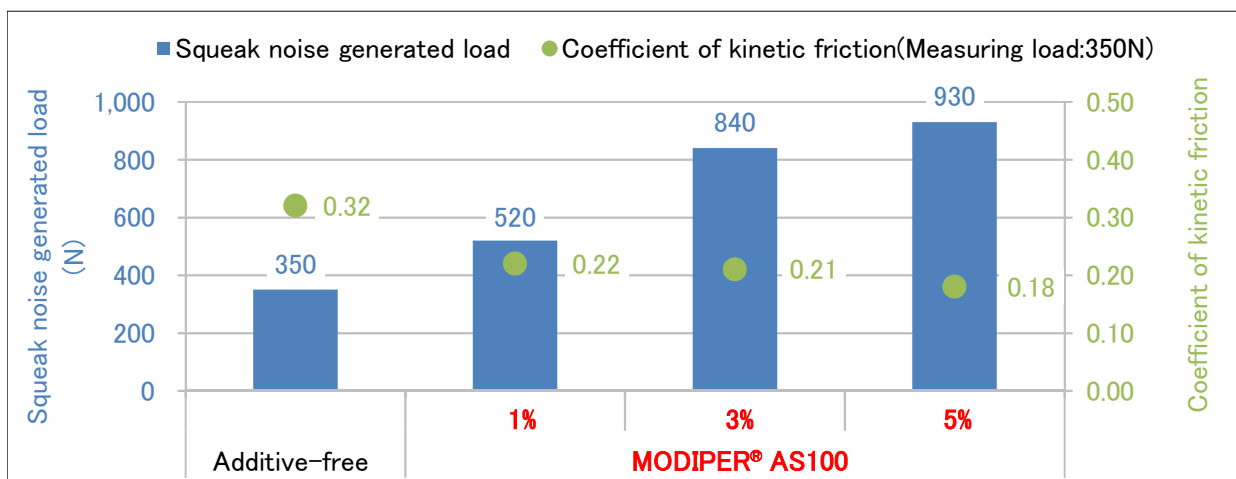


Figure 7. Evaluation of squeak noise by ring-on-ring test

③ PC/ABS

By adding MODIPER® AS100 into PC/ABS, the risk of squeak noise is reduced after the thermal stress. In addition, MODIPER® AS100 can make the coefficient of kinetic friction lower.

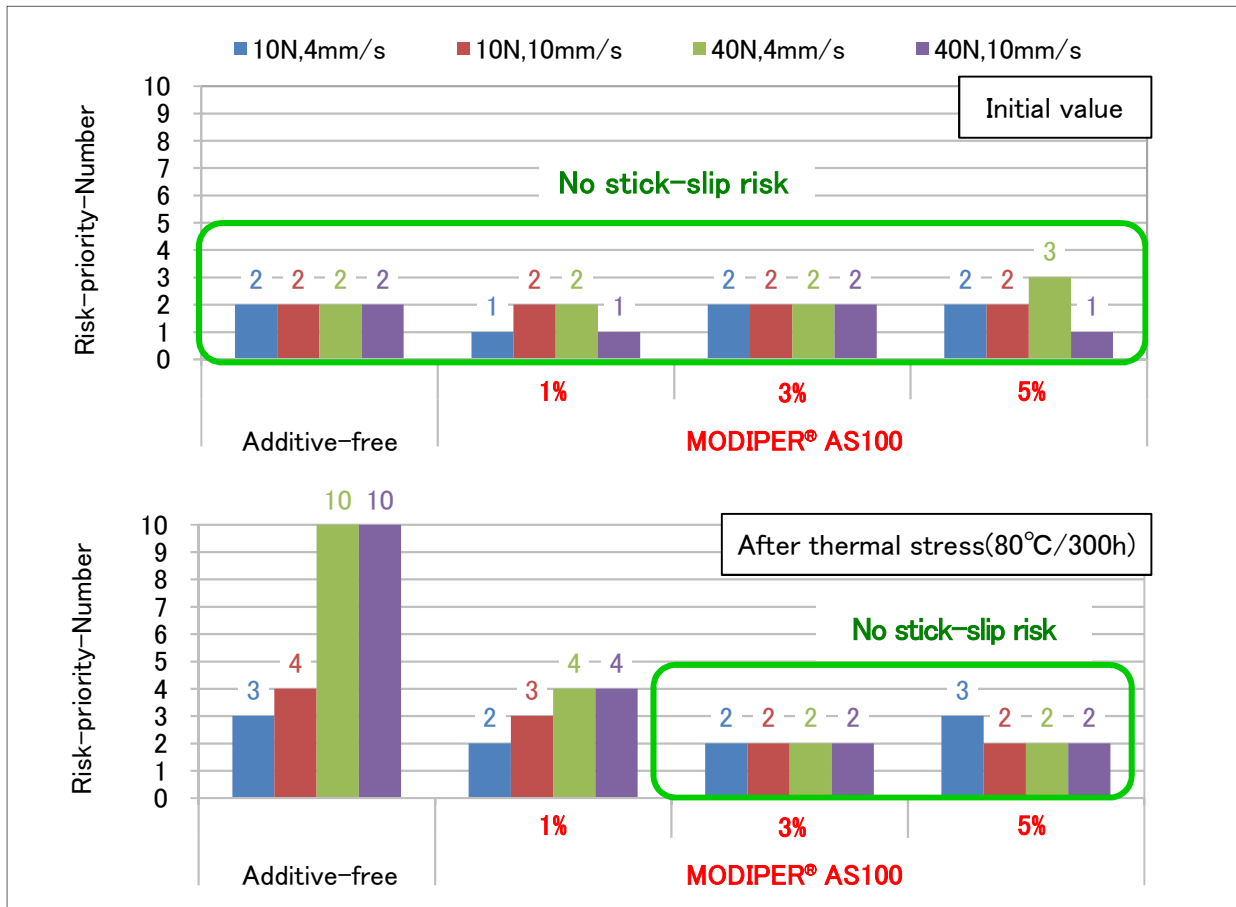


Figure 8. Evaluation of squeak noise by stick-slip test

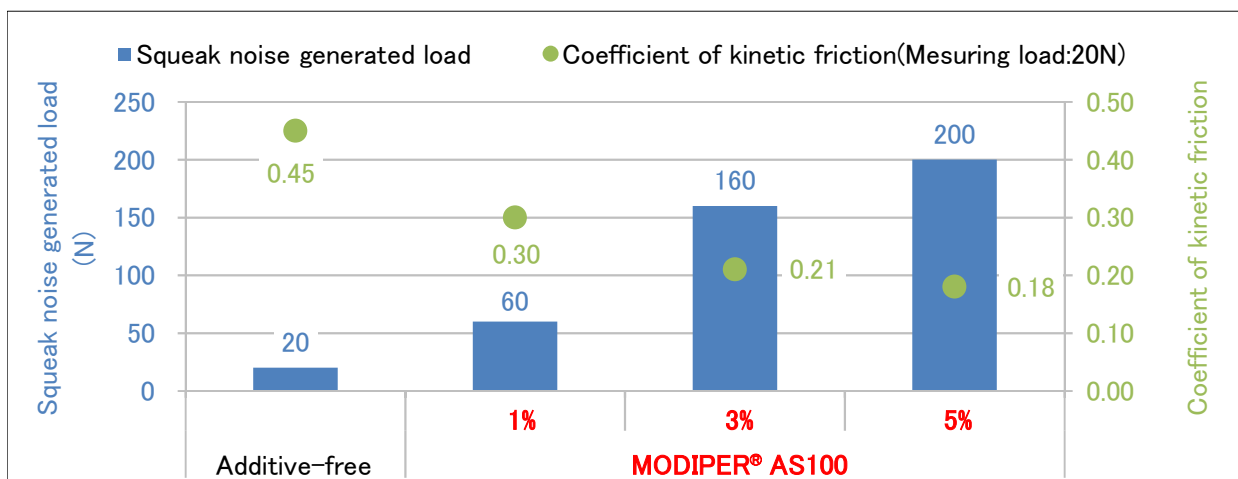


Figure 9. Evaluation of squeak noise by ring-on-ring test

6 Tribological improvement by MODIPER® AS100

① POM

MODIPER® AS100 can improve the tribological properties and reduce both the abrasion loss and coefficient of kinetic friction by adding into POM. Furthermore, MODIPER® AS100 shows better improvement than Polytetrafluoroethylene (PTFE).

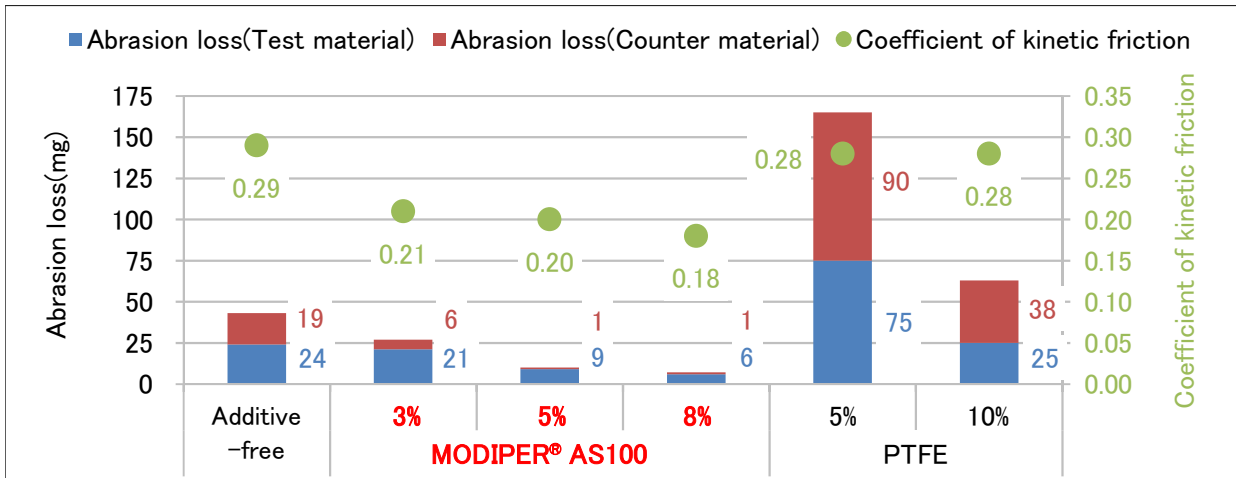


Figure 10. Evaluation of tribological properties by ring-on-ring test

② PA6

MODIPER® AS100 can improve the tribological properties and reduce both the abrasion loss and coefficient of kinetic friction by adding into PA6. Furthermore, MODIPER® AS100 shows better improvement than Polytetrafluoroethylene (PTFE).

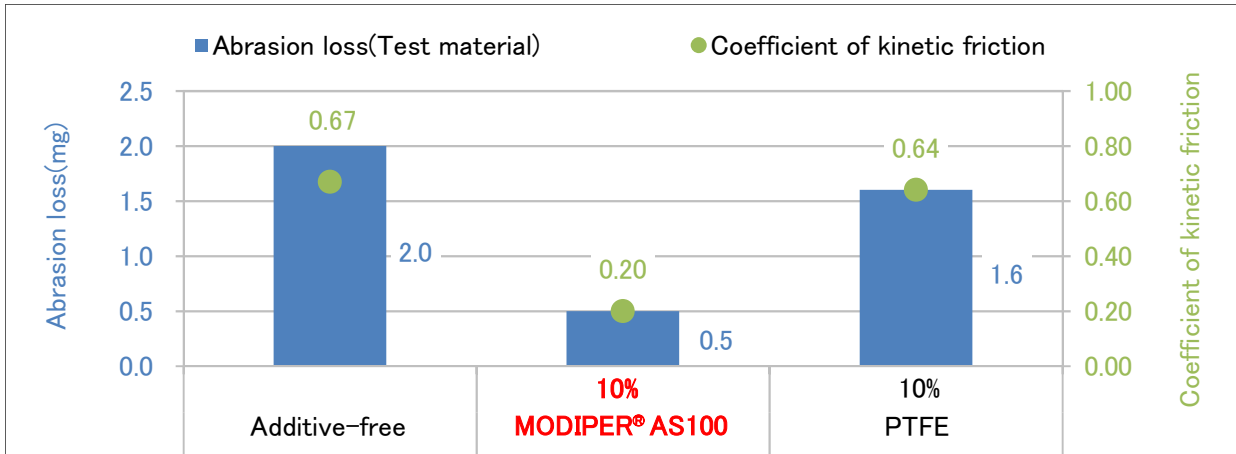


Figure 11. Evaluation of tribological properties by ring-on-ring test

7 Mechanical properties of each resin containing MODIPER® AS100

Table 5. Mechanical properties of each resin

Resin	Additive amount (%)	Tensile		Flexural		Izod impact (kJ/m ²)
		Strength (MPa)	Elongation (%)	Strength (MPa)	Modulus (MPa)	
POM	0	61	58	77	2,300	7.5
	3	57	53	74	2,300	5.6
	5	54	51	70	2,200	4.9
	8	50	43	66	2,000	4.6
ABS	0	50	14	72	2,400	16.2
	1	51	10	76	2,400	15.9
	3	47	36	70	2,300	12.8
	5	47	19	70	2,300	12.3
PC/ABS	0	49	67	75	2,100	37.6
	1	49	89	73	2,000	37.8
	3	46	52	67	2,000	34.3
	5	44	52	65	1,900	32.1
PA6	0	81	20	106	2,700	3.9
	10	59	41	75	2,100	5.8

8 Registration of MODIPER® AS100 for oversea chemical regulation

Table 6. Registration of MODIPER® AS100

Country / Region	Regulation / Existing chemical substances list	Present situation
Japan	ENCS	Listed
EU	REACH	Polymers; Exempt from registration * (Component monomer of polymer; Registered or Pre-registered)
America	TSCA	Not Listed * (Polymer Exemption)
China	IECSC	Not Listed * (Confirmed as Low Concern Polymers/ Registrant:NOF (Shanghai) Co., Ltd.)
Korea	ECL	Not Listed * (Confirmed as Low Concern Polymers)
Taiwan	TCSCA	Listed *

* Please contact us for details on export and import.

9 Shape, Package

- ◆ Shape : Pellet
- ◆ Color : White
- ◆ Package : 20kg in paper bag



Figure 12. Appearance of **MODIPER® AS100**

10 Notes

- ◆ **MODIPER® AS100** is short columnar pellet, it will be very slippery if spilled on the floor, it should be immediately recovered.
- ◆ 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.
- ◆ With regard to other common thing, please refer to the safety data sheet (SDS).

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