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SPECIFICATION

MOLD RELEASE AGENT

FIELD OF THE INVENTION

The present invention relates to a mold release agent. Particularly, it relates to a water-based mold release agent used for the preparation of a shaped article of a polymeric material such as a synthetic resin and a rubber.

RELATED ART AND PROBLEMS

Hitherto, an organic solvent-based mold release agent comprising a halogen-containing polyether as a main component is known (cf. Japanese Patent Kokai Publication No. 112610/1986). Although the mold release agent comprising the halogen-containing polyether has good mold releasability, it has the problem that the environment is polluted during the use of it since it contains the organic solvent. It is required to develop a water-based mold release agent comprising a halogen-containing polyether as the main component, which is free from the environmental pollution. The water-based mold release agent comprising the halogen-containing polyether as the main component which is disclosed in Japanese Patent Kokai Publication No. 112610/1986 has the problem that the mold release agent has poor storage stability (namely, the halogen-containing polyether is separated from the mold release agent).

SUMMARY OF THE INVENTION

An object of the present invention is to provide a water-based mold release agent which is free from the environmental pollution problem during its use, which has excellent dispersibility, storage stability and mold releasability and which gives a good surface

state to a molded article of a polymeric material.

The present invention provides a water-based mold release agent comprising, as a main component, a halogen-containing polyether having at least one functional group.

DETAILED DESCRIPTION OF THE INVENTION

The mold release agent according to the present invention comprises

- a) the halogen-containing polyether having at least one functional group,
- b) a surfactant, and
- c) water.

The halogen-containing polyether used in the present invention has at least one functional group, and the halogen-containing polyether having no functional group which is described in Japanese Patent Kokai Publication No. 112610/1986 is not preferable in the present invention.

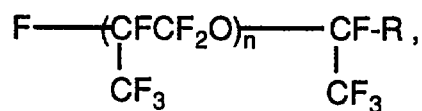
The halogen-containing polyether having at least one functional group may be well-known one and is described in Japanese Patent Kokai Publication No. 131132/1989 (corresponding to US Patent No. 4,836,944, the disclosure of which is incorporated herein by reference), Japanese Patent Kokai Publication No. 134189/1991, Japanese Patent Kokai Publication No. 268664/1989 (corresponding to US Patent No. 5,004,544, the disclosure of which is incorporated herein by reference), and Japanese Patent Kokai Publication No. 132917/1991.

A perfluoropolyether having at least one functional group is preferable. Specific examples of the preferable halogen-containing polyether are

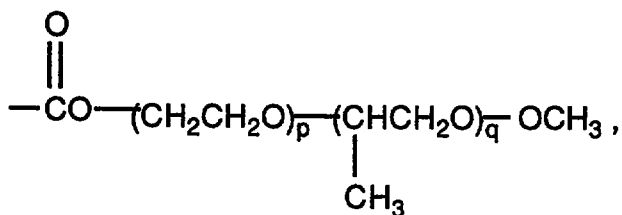
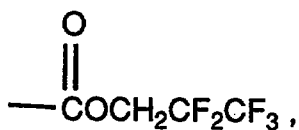
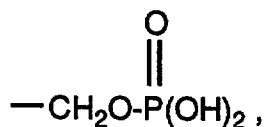
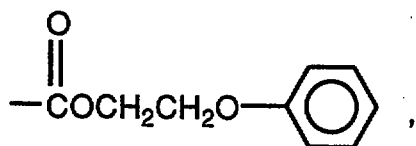
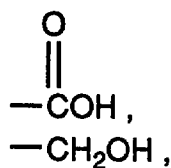


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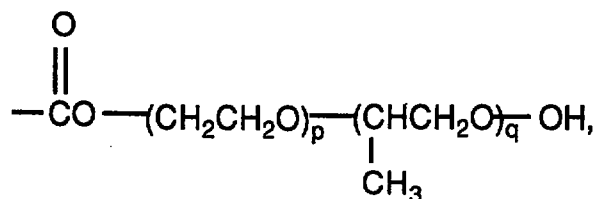




wherein R is



or



m is 1 to 50, n is 1 to 100, p is 0 to 100, q is 0 to 100 and r is 1 to 50.

A perfluoropolyether having a carboxylic acid group or salt

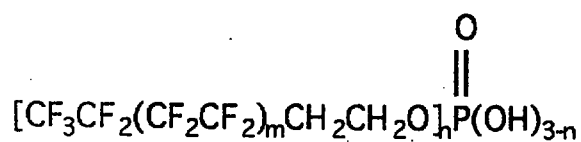
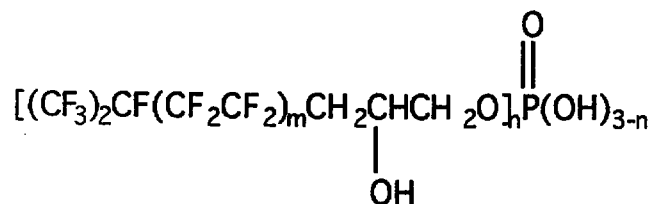
thereof is preferable in view of the adherence to a mold surface.

The halogen-containing polyether preferably has an average molecular weight of 1,000 to 5,000, more preferably 1,500 to 3,500.

The surfactant used in the present invention may be any of a hydrocarbon surfactant and a fluorine-containing surfactant. Specific examples of the surfactant are Rapizol B-80 (manufactured by Nippon Oil and Fats Co., Ltd.), Nonion NS 230 (manufactured by Nippon Oil and Fats Co., Ltd.), Nonion NS 220 (manufactured by Nippon Oil and Fats Co., Ltd.), Unidine DS 403 (Daikin Industries Ltd.). Among them, the nonionic surfactant is preferable in view of the storage stability. When a nonionic hydrocarbon surfactant is used, the mold release agent is transparent (no cloudiness) and has remarkably excellent storage stability.

The water-based mold release agent according to the present invention can be prepared, for example, by emulsifying the halogen-containing polyether, the surfactant and water by an ultrasonic homogenizer.

The water-based mold release agent according to the present invention may further contains d) a phosphate ester or a salt thereof having a perfluoroalkyl group having 4 to 20 carbon atoms. Specific examples of the perfluoroalkyl group-containing phosphate ester are



wherein m is 1 to 9, n is 1, 2 or 3.

In view of the stability, it is preferable that the halogen - containing polyether is emulsified in water and then the perfluoroalkyl group-containing phosphate ester is added to the emulsion.

The phosphate ester having the perfluoroalkyl group having 4 to 20 carbon atoms gives, for example, excellent releasability for a urethane.

The water-based mold release agent according to the present invention may contain a silicone or wax compound. The silicone or wax compound improves the surface state of the shaped article so as to reduce a cell collapse, particularly in the case of the polyurethane foam which tends to have the cell collapse.

Specific examples of the silicone compound are a silicone oil, a silicone resin, a mixture of silicone oil and resin. Specific example of the wax compound is a paraffinic wax.

The water-based mold release agent according to the present invention comprises

- a) 1 part by weight of the halogen-containing polyether,
- b) 0.02 to 0.8 parts by weight, preferably 0.1 to 0.5 parts by weight of the surfactant, and
- d) 0 to 1.0 parts by weight, preferably 0.1 to 0.8 parts by weight, more preferably 0.2 to 0.3 parts by weight of the perfluoroalkyl group - containing phosphate ester or salt thereof.

The amount of silicone or wax compound is from 0 to 5.0 parts by weight, preferably from 0 to 1.0 parts by weight per 1 part by weight of the halogen-containing polyether.

The water-based mold release agent according to the

present invention may contain usually 0.1 to 20 % by weight, preferably 0.5 to 10 % by weight of the components other than water c). The mold release agent can be used in a low concentration, migrates to the shaped article in a very low amount, and gives an easy post-treatment (good coating property and adhesion property).

The mold release agent according to the present invention can be used as an internal mold release agent, but it is preferably used as an external mold release agent. When the mold release agent according to the present invention is coated on a mold, any of a brush coating method, a dip coating method, a spray coating method and the like can be used.

The mold release agent according to the present invention is useful for the preparation of the shaped article made of a synthetic resin and a rubber, particularly a polyurethane or a polyurea.

PREFERRED EMBODIMENT OF THE INVENTION

The present invention will be illustrated by the following Examples and Comparative Examples.

Examples 1 to 11 and Comparative Examples 1 to 4

A mold release agent was prepared by emulsifying the components shown in Table 1 at 25°C for 6 minutes by the use of an ultrasonic homogenizer (manufactured by Choonpakogyo Co. Ltd., Output: 300 W).

Then, the mold release agent was coated on a mold, and a urethane foam was molded from a liquid A and a liquid B shown in Table 2.

The mold releasability and the surface state of the shaped article were evaluated. A mold release stress (g/cm^2) was measured by the use of an autographic device (manufactured by Shimadzu Corp.,

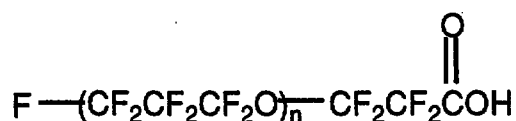
DCM-50M). The results are shown in Table 3. Table 3 also show stability of the mold release agent.

Table 1

Example No.	Halogen - containing polyether	Hydrocarbon surfactant	Phosphate ester having perfluoroalkyl group	Medium
1	Demnum SH 5%	NS 230 0.10%	-	Water
2	Demnum SH 5%	NS 230 0.25%	-	Water
3	Demnum SH 5%	NS 230 0.50%	-	Water
4	Demnum SH 5%	NS 230 1.00%	-	Water
5	Demnum SH 5%	NS 230 1.50%	-	Water
6	Demnum SH 5%	NS 230 2.50%	-	Water
7	Demnum SP 5%	NS 230 1.00%	-	Water
8	Demnum P 5%	NS 230 1.00%	-	Water
9	Demnum SH 5%	NS 230 1.00%	1.5%	Water
10	Demnum SH 5%	DS-403 0.25%	-	Water
11	Demnum SH 5%	DS-403 0.25%	1.5%	Water
Com. 1	Demnum S-20 5%	NS 230 1.00%	-	Water
Com. 2	Demnum S-20 5%	-	-	Trifluoro chloroethane
Com. 3	Silicone emulsion SH 7036 (manufactured by Toray-Dow Corning Ltd.) 5%	-	-	Water
Com. 4	Wax emulsion EM 0001 (manufactured by Nippon Seiroh Ltd.) 5%	-	-	Water

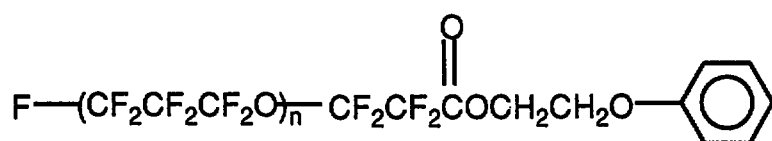
Note)

Demnum SH: manufactured by Daikin Industries Ltd.



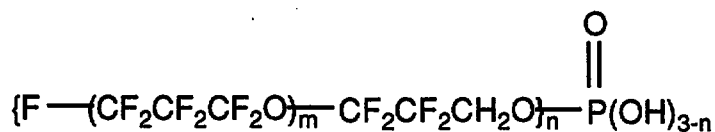
(n is from 20 to 22)

Demnum SP: manufactured by Daikin Industries Ltd.



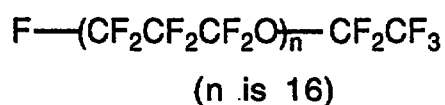
(n is from 20 to 22)

Demnum P: manufactured by Daikin Industries Ltd.

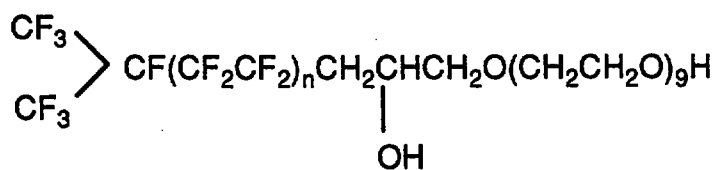


(m is from 20 to 22, and n is 1, 2 or 3)

Demnum S-20: manufactured by Daikin Industries Ltd.

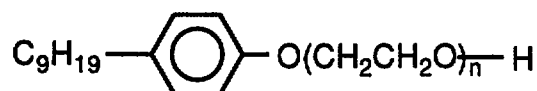


DS-403: Unidine DS-403 manufactured by Daikin Industries Ltd.



(n is 1 to 9)

NS-230: manufactured by Nippon Oil and Fats Co. Ltd.



(n is 30)

Table 2

Liquid A	Sannix FA-912	Polyol	100 pbw	manufactured by San - yo Chemical Industries Ltd.
	Ethylene glycol	Cross-linking agent	9 pbw	(ditto)
	Flon 11U	Foaming agent	15 pbw	(ditto)
	DABCO 33LV	Catalyst	4 pbw	(ditto)
Liquid B	Colonate 1040	Isocyanate	65 pbw	manufactured by Nippon Polyurethane Ltd.

Molding conditions:

Mold material	aluminum
Mold size	5.5 cm diameter x 1.0 cm
Stirring time	5,000 rpm x 10 seconds
Foaming and curing time	10 minutes
Mold temperature	40°C
Method of coating the mold release agent	brush-coating at room temperature

Table 3

Example No.	Stability	Mold releasability (g/cm ²)	Surface state
1	Good	160	Good
2	Good	170	Good
3	Good	95	Good
4	Very good	110	Good
5	Very good	125	Good
6	Very good	150	Good
7	Good	150	Good
8	Good	230	Good
9	Good	100	Good
10	Good	150	Good
11	Good	160	Good
Com. 1	Bad	190	Good
Com. 2	Very good	230	Pinholes formed
Com. 3	Very good	300	Good
Com. 4	Very good	350	Good

Note)

Stability:

Very Good: Transparent (not separated after two weeks)

Good: Milky white (separated after one week)

Bad: Milky white (separated after two days)

Surface state:

Good: No cell collapse

EFFECTS OF THE INVENTION

The water-based mold release agent according to the present invention gives no environmental pollution, has excellent dispersibility, storage stability and mold releasability and gives a good surface state to the shaped article of the polymeric material.

In addition, the water-based mold release agent according to the present invention forms a reversed micelle having the functional

group present in water. The water-based mold release agent according to the present invention is adsorbed easily and selectively by the mold surface and can form a tough coating film having good durability. The water-based mold release agent according to the present invention can give more uniform thickness of a coating film than an organic solvent-based mold release agent.



What is claimed is:

1. A water-based mold release agent comprising, as a main component, a halogen-containing polyether having at least one functional group.
2. The water-based mold release agent according to claim 1, which comprises
 - a) the halogen-containing polyether having at least one functional group,
 - b) a surfactant, and
 - c) water.
3. The water-based mold release agent according to claim 1 or 2, wherein the halogen-containing polyether is a perfluoropolyether.
4. The water-based mold release agent according to claim 2 or 3, which further contains d) a phosphate ester or salt thereof having a perfluoroalkyl group having 4 to 20 carbon atoms.
5. The water-based mold release agent according to anyone of claims 2 to 4, wherein the surfactant is a nonionic surfactant.
6. The water-based mold release agent according to anyone of claims 1 to 5, wherein the functional group is a carboxylic acid group or salt thereof.

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