Bulletin No. E810807302A
Date issued: April 1, 2010

Polymer-Alloy Type Permanent Antistatic Agent for Styrene Resins

PELESTAT 1251

Preface

PELESTAT 1251 is a polymer-alloy type thermoplastic elastomer composed of hydrophilic and lipophilic segments. This product imparts a permanent antistatic property to styrene resins such as ABS resins and styrene-acrylic resins (MS resins) while causing practically no lowering of the physical properties and moldability of the resins themselves.

Typical Properties

Property	Value	Remarks
Appearance	Pale yellow pellet	−
Melting point	Approx. 148°C (298°F)	DSC, ASTM D 3418
Melt flow rate	Approx. 10 g	10 min, ASTM D 1238 [210°C (410°F), 21.18 N]
Refractive index	Approx. 1.51	23°C (73°F), ASTM D 542
Surface resistivity	Approx. 1×10^{9} Ω	ASTM D 257
Saturated water content	Approx. 0.9 %	23°C (73°F), 50 % R.H.
Thermal degradation temperature	Approx. 260°C (500°F)	*

* The lowest temperature at which PELESTAT 1251 begins to thermally decompose. (Measured using a thermal gravimeter in air)

Features

PELESTAT 1251 has the following features:

· Imparts an excellent antistatic property to plastics such as ABS resins and MS resins when the amount added is between 10 and 15 wt %.

· Applicable to electrics/electronics due to its material that causes no gaseous reaction.

· Has low hygroscopic properties. Its saturated water content is approx. 0.9% at 23°C (73°F), 50 % R.H.

· Exhibits a permanent antistatic property immediately after molding. The antistatic property in the resulting plastic minimally changes even after washing with water because it is a high-molecular-weight antistatic agent. In addition, it works even in low humidity due to its low dependency on humidity.

· Minimally affects the mechanical and surface properties of the resins themselves.

Application Methods

1. General Procedure

As shown in Figure 1, PELESTAT 1251 and a styrene resin are dry-blended using a blender, and are kneaded and pelletized using a twin-screw extruder, etc.

Dispersants, fillers and pigments can be added during the dry-blending or the kneading process if necessary.

This blend is then molded into the final product using an appropriate molder (e.g. injection molding machine).

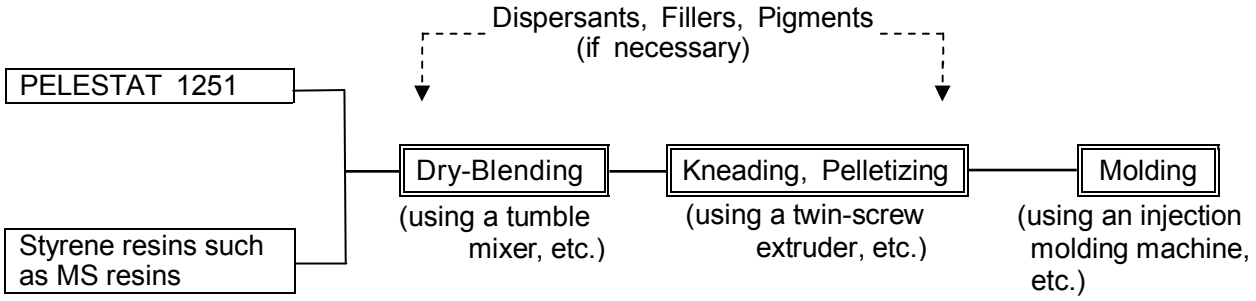

Figure 1. General Procedure for Application of PELESTAT 1251

2. Amount to be Used

The standard amount of PELESTAT 1251 is between 10 and 15 wt %.

Determine the optimal amount by referring to the results of its performance tests.

3. Kneading Conditions

Use a high share rate kneader (e.g. twin-screw extruder) when this product is kneaded.

The standard kneading temperature is between 210°C and 250°C (410°F – 482°F).

Determine the kneading temperature according to the resin applied.

4. Drying of PELESTAT 1251

· This product can be immediately used after the factory sealed package is opened because this product is packed into a bag under moisture-proof conditions.

· Drying is necessary when the factory sealed package is kept unsealed for several hours because this product has some hygroscopic properties.
The following are examples of the conditions for drying.

Drying under reduced pressure
Vacuum : Below 1300 Pa (0.2 psi)
Temperature : 70°C – 80°C (158°F – 176°F)
Duration : 2 – 4 hours

Hot-air drying
Temperature : 85°C – 95°C (185°F– 203°F)
Duration : 4 – 6 hours

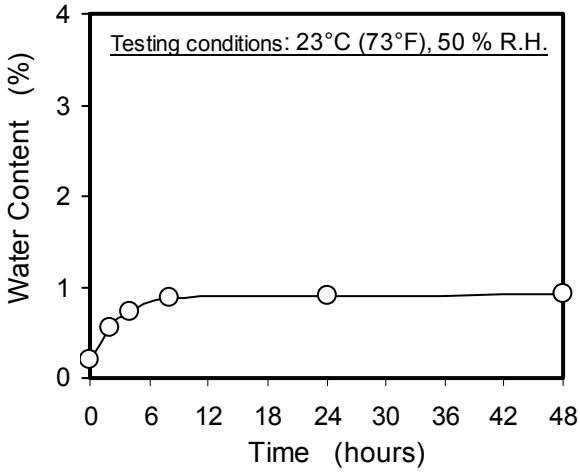

Figure 2. Hygroscopic Properties of PELESTAT 1251

Precaution Against Mishandling

· In the case of using resins with molding temperatures below 150°C (302°F), PELESTAT 1251 may not fuse, possibly resulting in poor effectiveness. Furthermore, in case of using resins at molding temperatures above 260°C (500°F), this product may thermally decompose, possibly resulting in poor effectiveness. The recommended molding temperature is between 210°C and 250°C (410°F – 482°F).

· Depending on the kind of resin, this product may have an influence on the resin's physical properties such as mechanical properties. Test their influence on each other's physical properties beforehand to ensure that there are no problems.

Performance Tests

The examples on pages 4 to 8 are the results of performance tests using ABS resins and MS resins mixed with PELESTAT 1251.

This product imparts a permanent antistatic property to these thermoplastic resins that cannot be attained by any other conventional blend-type, low-molecular-weight antistatic agents. Furthermore, this product minimally affects the physical properties of these thermoplastic resins because this product is highly compatible with them.

1. Application to ABS Resins

A. Relationship Between Amount of PELESTAT 1251 and Resulting Surface Resistivity

The ABS resin containing PELESTAT 1251 is highly antistatic when the amount of this product added is between 10 and 15 wt %. Refer to Figure 3 and determine the optimal amount according to the desired surface resistivity.

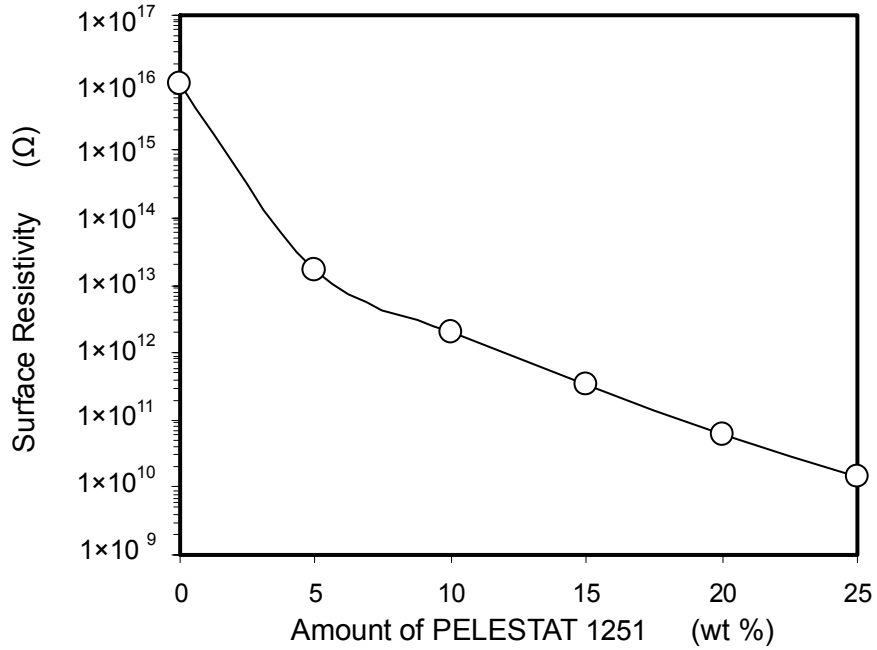

Figure 3. Relationship Between Amount of PELESTAT 1251 and Surface Resistivity

Materials and Methods:

Materials:

A predetermined amount of PELESTAT 1251 was dry-blended with the ABS resin and the mixture was kneaded using a twin-screw extruder at approx. 230°C (446°F). The kneaded compound was then molded using an injection molding machine [nozzle temperature: approx. 230°C (446°F), mold temperature: approx. 50°C (122°F)] into samples 2 mm (approx. 0.08 inches) in thickness.

Method:

Each sample was kept at 23°C (73°F), 50 % R.H. for 24 hours. Then, the surface resistivity of each was measured with a megohmmeter according to ASTM D 257.

B. Effect on Surface Resistivity When Washed with Water (Evaluation of Durability of Antistatic Effect)

The surface resistivity of the ABS resin blended with PELESTAT 1251 minimally changes, remaining antistatic even when washed with water. This product imparts a permanent antistatic property that cannot be attained by any other conventional blend-type, low-molecular-weight antistatic agent, which loses its antistatic property after being washed with water approximately three times.

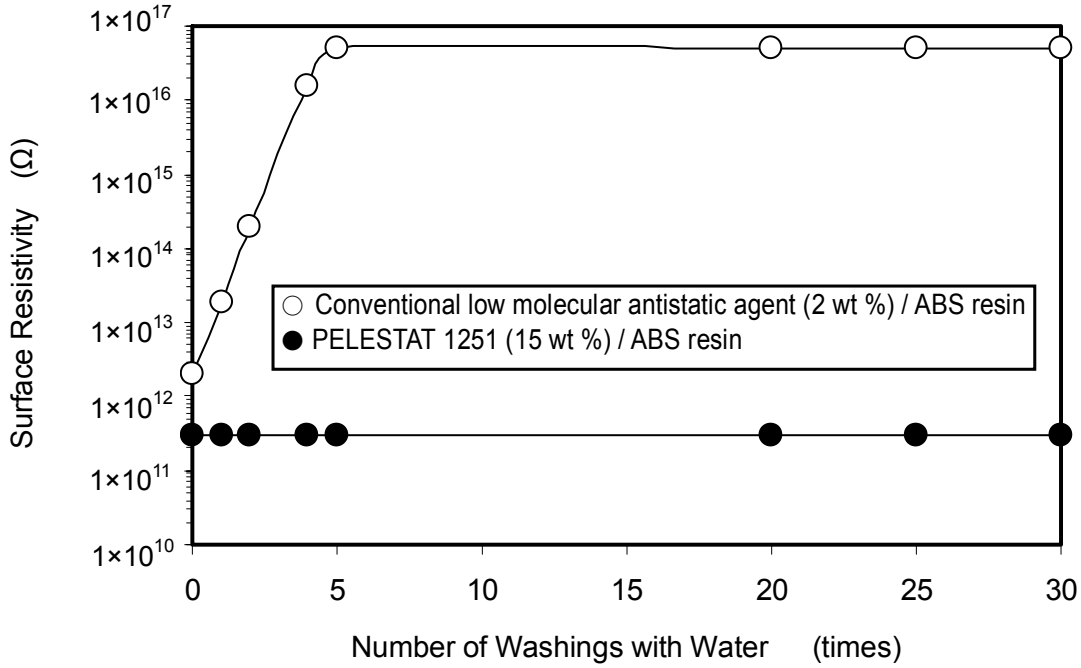

Figure 4. Effect on Surface Resistivity When Washed with Water

Materials and Methods:

Materials:

PELESTAT 1251 (15 wt %) / ABS resin

PELESTAT 1251 (15 wt %) was dry-blended with the ABS resin and the mixture was kneaded using a twin-screw extruder at approx. 230°C (446°F). The kneaded compound was then molded using an injection molding machine [nozzle temperature: approx. 230°C (446°F); mold temperature: approx. 50°C (122°F)] into samples 2 mm (approx. 0.08 inches) in thickness.

Conventional low-molecular-weight anionic antistatic agent (2 wt %) / ABS resin

A conventional blend-type, low-molecular-weight antistatic agent, a Sanyo Chemical product, was applied. These samples were prepared by using the method described above.

Method:

Each sample was submerged in water and their surfaces were rubbed with a cotton cloth. The samples were dried under reduced pressure [133 Pa (0.02 psi)] at 70°C (158°F) for 2 hours and were kept at 23°C (73°F), 50 % R.H. for 24 hours. The surface resistivity was measured with a megohmmeter according to ASTM D 257. This process was repeated according to the number of washings with water as described in Figure 4.

C. Effect of Humidity on Surface Resistivity

The surface resistivity of the ABS resin blended with PELESTAT 1251 minimally changes even in low humidity due to this product's low dependency on humidity. Conversely, an ABS resin blended with any other conventional low-molecular-weight antistatic agent loses its antistatic property in low humidity.

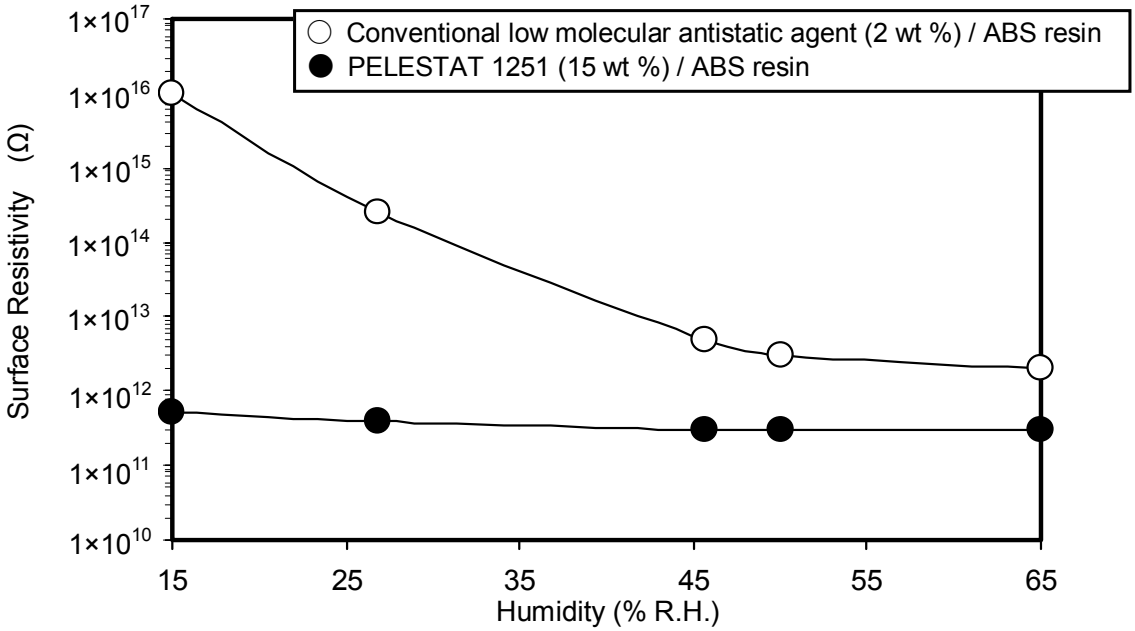

Figure 5. Effect of Humidity on Surface Resistivity

Materials and Methods:

Materials:

See Figure 4.

Method:

Each sample was kept at 23°C (73°F) at a predetermined humidity for 24 hours. Then, the surface resistivity of each was measured using a megohmmeter according to ASTM D 257.

D. Effect on Resin Physical Properties

As shown in Table 1, PELESTAT 1251 minimally affects the resin's properties of ABS resin.

Table 1. Effect on ABS Resin Physical Properties

Property		Method (ASTM No.)	PELESTAT1251 (15wt%) / ABS	ABS Resin
Surface resistivity	Ω	D 257	3×10^{11}	$> 10^{16}$
Tensile strength	MPa (psi)	D 638	35 (5,100)	40 (5,800)
Flexural modulus	MPa (psi)	D 790	1,600 (232,000)	1,800 (261,000)
Izod impact strength (notched)	J/m (ft･lbf/in)	D 256	170 (3.2)	150 (2.8)

Materials and Methods:

Materials:

Surface resistivity

PELESTAT 1251 (15 wt %) was dry-blended with an ABS resin and the mixture was molded using an injection molding machine under the same conditions as described in Figure 4 into samples 2 mm (approx. 0.08 inches) in thickness.

Other mechanical properties

Samples were prepared under the same conditions described in Figure 4 except that the predetermined size described in ASTM was applied.
ABS resin was also molded under the same conditions.

Methods:

See the ASTM No. described in Table 1.
(The testing method for surface resistivity is described in Figure 3.)

E. Dispersibility of PELESTAT 1251 in ABS Resins

As shown in Figure 6, PELESTAT 1251 is finely dispersed in the ABS resin.

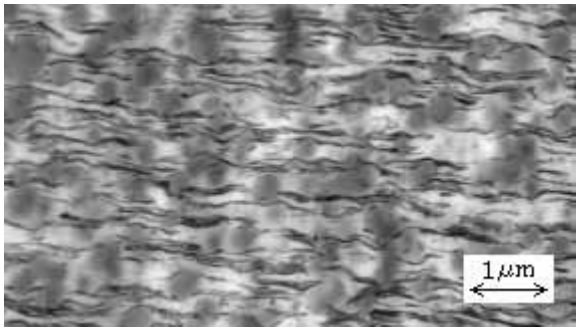

Figure 6. Transmission Electron Micrograph of Molding (TEM photo)
Composed of PELESTAT 1251 (15 wt %) and ABS Resin

[Explanation of Photograph]

Black stripes: PELESTAT 1251
Black particles: Butadiene component of ABS resin

Figure 6 is a magnification (approx. 10,000 times) of a section of the PELESTAT 1251 (15 wt %)/ABS resin mixture described in Figure 4. This product (black stripes) is dispersed in ABS Resin (white portion) and works as a conductive network.

2. Application to MS Resin

A. Effect on MS Resin's Physical Properties

As shown in Table 2, PELESTAT 1251 imparts a permanent antistatic property to the MS resin. The compatibility of this product with this resin is excellent, and the resin's physical properties show minimal change.

Table 2. Effect on MS Resin's Physical Properties

Property		Method ASTM No.	PELESTAT 1251 (15 wt %) / MS Resin	MS Resin *
Surface resistivity	Ω	D 257	3×10^{11}	$> 10^{16}$
Tensile strength	MPa (psi)	D638	60 (8,700)	69 (10,000)
Flexural modulus	MPa (psi)	D790	2,600 (377,000)	2,900 (421,000)
Izod impact strength (notched)	J/m (ft·lbf/in)	D256	35 (0.7)	30 (0.6)

* Refractive index of the resin: approx. 1.51 [23°C (73°F)]

Materials and Methods:

Materials:

PELESTAT 1251(15 wt %)/MS resin

PELESTAT 1251 (15 wt %) was dry-blended with the MS resin (refractive index: approx. 1.51) and the mixture was kneaded using a twin-screw extruder at approx. 220°C (428°F). The kneaded compound was then molded using an injection molding machine [nozzle temperature: approx. 220°C (428°F); mold temperature: approx. 60°C (140°F)] into a predetermined sample.

MS resin

The MS resin was molded under the conditions described above.

Methods:

See the ASTM No. described in Table 2.
(The testing method for surface resistivity is described in Figure 3.)

B. Relationship Between Amount of PELESTAT 1251 and Resin Optical Property

PELESTAT 1251 has an approximately refractive index of approx. 1.51. When this product is added to MS resins (refractive index: 1.51 to 1.57), a MS resin with a refractive index of approx. 1.51 should be used so that this product minimally affects the MS resin's transparency.

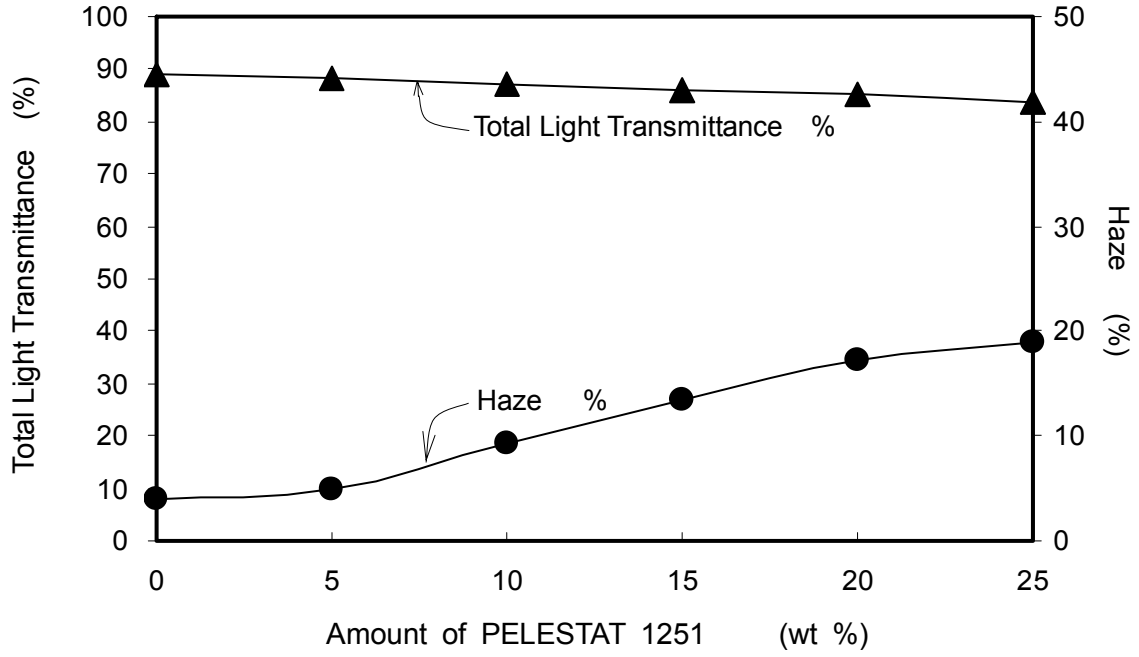

Figure 7. Relationship Between Amount of PELESTAT 1251 and Resin Optical Property

Materials and Methods:

Materials:

A predetermined amount of PELESTAT 1251 was dry-blended with the MS resin (refractive index: approx. 1.51) and the mixture was kneaded using a twin-screw extruder at approx. 220°C (428°F). The kneaded compound was then molded using an injection molding machine [nozzle temperature: approx. 220°C (428°F); mold temperature: approx. 60°C (140°F)] into samples 2 mm (approx. 0.08 inches) in thickness.

Method:

The samples were kept at 23°C (73°F) and 50 % R.H. for 48 hours.
Total light transmittance and haze were measured using a hazemeter according to ASTM D 1003.

Examples of Applications

PELESTAT 1251 has been used as a permanent antistatic agent in styrene resins such as ABS resins, HIPS resins, MS resins (including transparent ABS resins and MBS resins), polyester resins such as PBT, nylon resins and PC/ ABS alloys in the following applications:

- Housings for home electric applications, OA equipment, etc.
- Housings and storage cases of video game hardware, magnetic tapes, etc.
- Lighting fixture covers, meter panels, etc.
- IC trays, containers, etc.

Patent Registered

USP 5,652,326	EP 0,613,919
USP 5,886,098	TW NI - 83,929
USP 5,604,284	KR 300,273

Hazards Description

PELESTAT 1251 is a polyether-ester-amide type copolymer.
This product is insoluble in water.
This product has no flash point (by COC) below 230°C (446°F).
This product may have low acute oral toxicity.
Acute oral toxicity (rat): LD_{50}> 2,000 mg/kg (similar product)
Based on data from a similar product made by Sanyo Chemical, this product may not be irritating to the skin, but particles may injure cornea, and vapor or fume from molten material causes eye and nose irritation.
UN dangerous goods regulations are not applied to this product.
This product is for industrial use only.

Important :

Before handling this product, refer to the Material Safety Data Sheet for recommended protective equipment, and detailed precautionary and hazards information.

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