

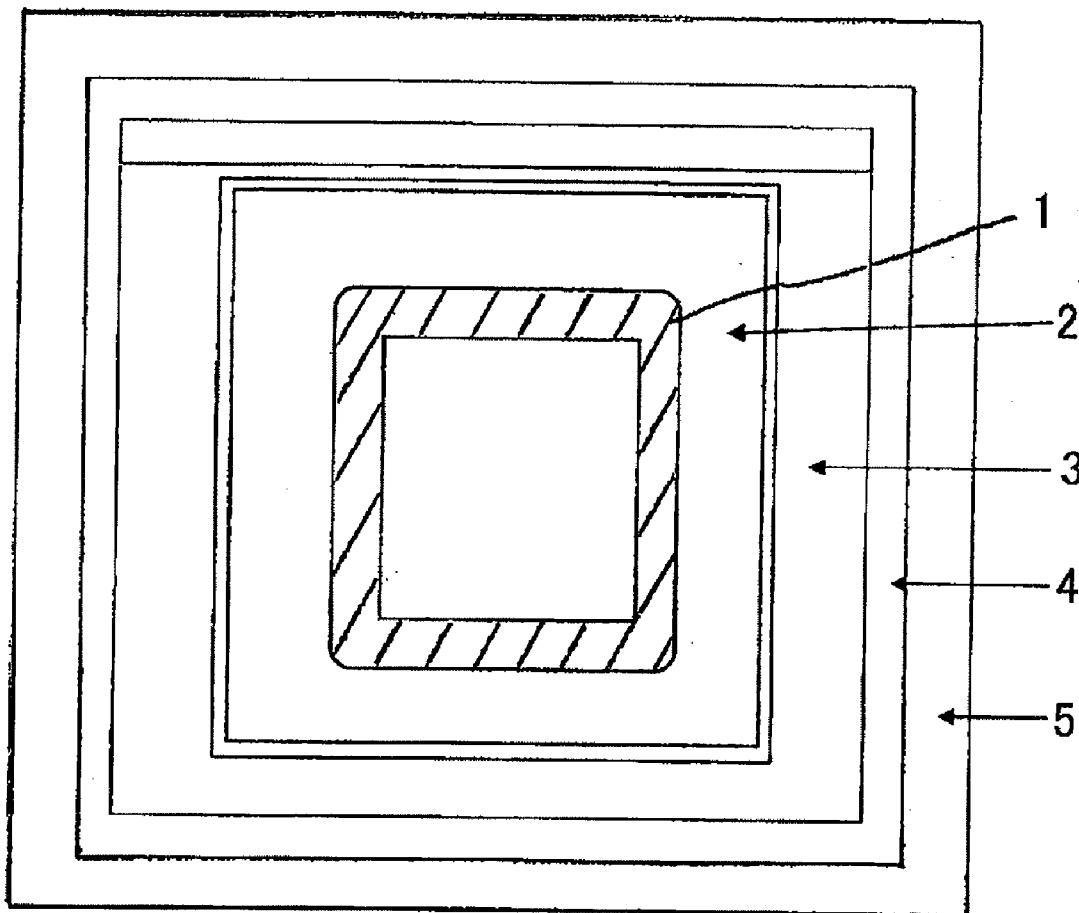


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(19) **United States**(12) **Patent Application Publication**
NAGATA(10) **Pub. No.: US 2012/0247069 A1**(43) **Pub. Date: Oct. 4, 2012**(54) **METHOD FOR STORING A PELLICLE****Publication Classification**(75) Inventor: **Yoshihiko NAGATA**, Annaka-shi
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LTD., Tokyo (JP)(52) **U.S. Cl.** **53/467**(21) Appl. No.: **13/430,110**(57) **ABSTRACT**(22) Filed: **Mar. 26, 2012**(30) **Foreign Application Priority Data**

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There is provided a method for packing a pellicle container in plastic resin bags, which is meant to prevent foreign particles from reaching the pellicle container and eventually the product pellicle; the points of the invention lie in that bags are either antistatic or of special cleanroom-use grade prepared and preserved in a cleanroom environment.



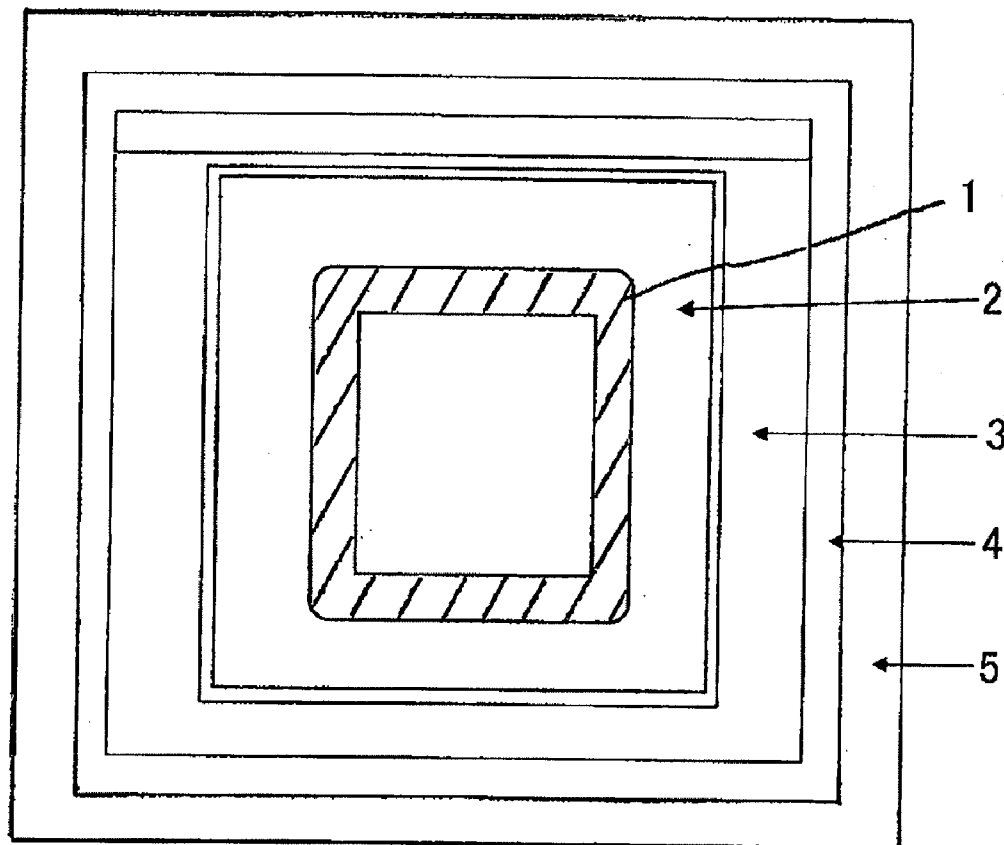


Fig. 1

METHOD FOR STORING A PELLICLE

PRIORITY CLAIMED

[0001] The present non-provisional application claims priority, as per Paris Convention, from Japanese Patent Application No. 2011-071582 filed on Mar. 29, 2011, the disclosure of which is hereby incorporated by reference herein in its entirety.

FIELD OF THE TECHNOLOGY

[0002] The present invention relates to a method for storing a pellicle or the like which is finished in the manufacturing process conducted in a clean room.

BACKGROUND OF THE INVENTION

[0003] A pellicle for lithography manufactured in a clean room is stored in a container tailored for it and then wrapped in a bag made of a synthetic resin. In order to prevent the pellicle container and the pellicle from taking electrostatic charge, the bag adopted is commonly of antistatic type.

[0004] In the case of an antistatic type bag, an antistatic additive is ingrained in the bag material or a metallic film is deposited on the bag surface so as to provide the bag with electric conductivity; however, these become sources of foreign particle generation, and thus are apt to contaminate the pellicle container packed in the bag, depending on the severity of the circumstances wherein the pellicle container is transported or exposed, and furthermore as the container is removed from the bag and is opened, the antistatic agent or the like sticking to the lid or other parts of the pellicle container would contaminate the pellicle stored in the container.

SUMMARY OF THE INVENTION

Problems the Invention Seeks to Solve

[0005] In view of the above circumstances, it is an object of the present invention to provide a method for storing a pellicle whereby foreign particle generation is restricted during the storage, transportation and unpacking, the pellicle stored in the pellicle container or the like is scarcely contaminated.

Means to Solve the Problems

[0006] The present invention was contrived to attain this object and the pellicle storing method according to the present invention is characteristic in that a container storing a pellicle is placed in a first bag of cleanroom-use grade, and after closing the first bag the first bag is placed in a second bag having an antistatic function, and after closing the second bag the second bag is placed in a third bag having an antistatic function and then the third bag is closed.

[0007] The bag of cleanroom-use grade can be a bag made in a cleanroom of cleanliness class 1000 or cleaner, according to Federal Standard 209E Airborne Particulate Cleanliness Classes, and the bags having the antistatic function have a surface resistance of 9.9×10^{11} ohm/cm² or lower. Also, it is

preferred that the bag closing work is conducted in a cleanroom of cleanliness class 1 or cleaner.

Effects of the Invention

[0008] According to the present invention, a clean bag is used as the innermost first bag, and antistatic bags are used as the second and third bags whereby foreign particles are prevented from sticking to the container of the product pellicle as well as the product pellicle itself, and also the occurrence of electrostatic charge is minimized and thus the product contamination is prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a schematic drawing to show how a pellicle is stored according to the present invention.

EMBODIMENT OF THE INVENTION

[0010] The present invention relates to a method for storing a pellicle container packed with a product pellicle, in a cleanroom, and the invention requires that the pellicle container packed with the pellicle be enveloped in a three-ply manner, i.e., in a three-bag system consisting of, from inner to outer, an innermost clean bag without antistatic function, a second innermost antistatic bag, and an outermost antistatic bag, so that the pellicle container is not allowed to be in direct contact with a bag carrying an antistatic additive, and as the result the pellicle stored in the pellicle container is kept safe from contamination and the outer antistatic bags prevent the occurrence of electrostatic mishap caused by static charge on the bags.

[0011] Now we will explain the present invention in detail using FIG. 1 as reference. In FIG. 1, bags 3, 4, and 5 are seen transparent, but any one of them can be opaque.

[0012] It is seen from FIG. 1 that a pellicle container 2 packed with a pellicle 1, of which the frame is hatched, is inside a first bag 3 of cleanroom-use grade, and the first bag 3 is enclosed in an antistatic second bag 4, and the second bag 4 is enclosed in an antistatic third bag 5.

[0013] The sizes of the bags used in the present invention must be such that each bag can contain the respectively expected contents thereof. The thicknesses and qualities of the resin sheets to make the bags preferably are such that they allow closing of the respective bag by thermal sealing without the bag being over-softened or destroyed by the heat applied to it. If the thickness is too large, it is not easy to molten the sheet for the sealing so that the preferable thickness may be 50-200 micrometers.

[0014] The material to make the bag is not limited, but with respect to the innermost (first) bag which comes in direct contact with the pellicle container, it would be preferable to adopt a resin such as polyethylene, nylon, polypropylene, and polyester, or a composite sheet consisting of layers of two or more of these materials. The first bag must be such a one as is of cleanroom-use grade, and manufactured in a cleanroom of cleanliness class 1000 or cleaner, and has been preserved under clean conditions.

[0015] This first bag 3 is contained in the second bag 4. Like the first bag, the second bag may be made of a resin such as

polyethylene, nylon, polypropylene, and polyester, or a composite sheet consisting of layers of two or more of these materials, plus a metallic layer deposited on the resin or an antistatic agent engrained in the resin for the creation of antistatic characteristic. As for the degree of the antistatic characteristic to impart to the resin, it is desirable if the bag will have a surface resistivity of 9.9×10^{11} ohm/cm² or lower, which is the case commonly adopted in the antistatic commodities.

[0016] The pellicle container packed in the first and the second bags is then put into the third bag 5. The third bag 5, being disposed to come in direct contact with the external environment, is supposed to be opened immediately before the content is brought into the cleanroom so as to avoid the entrance of the contamination on the third bag 5 into the cleanroom.

[0017] Therefore, depending on the cleanliness of the cleanroom into which the content is brought, the number of the bags in which the pellicle container is contained may be increased.

[0018] Like the second bag, the third bag may be made of a resin such as polyethylene, nylon, polypropylene, and polyester, or a composite sheet consisting of layers of two or more of these materials, plus a metallic layer deposited on the resin or an antistatic agent engrained in the resin for the creation of antistatic characteristic.

[0019] The same applies to a fourth bag, a fifth and so on.

Examples

[0020] Now, we will describe examples of the present invention. In the following example, reference examples, and comparative examples, the bags of cleanroom-use grade used were polyethylene bags which had been made and cleansed in cleanrooms of cleanliness class 1000 or cleaner, and the antistatic bags used were polyethylene bags which had been engrained with an antistatic agent to have antistatic function (surface resistivity of 9.9×10^{11} ohm/cm² or lower).

Example 1

[0021] First, a pellicle container packed with a pellicle was inserted into a first bag of cleanroom-use grade having a sheet thickness of 70 micrometers until the former reached the bottom of the latter, and the opening of the bag was thermally sealed off. Next, the first bag containing the pellicle container was inserted into an antistatic second bag with a sheet thickness of 70 micrometers, and the opening of the second bag was sealed off thermally.

[0022] Lastly, the sealed second bag was inserted into an antistatic third bag with a sheet thickness of 100 micrometers, and the opening of the latter was thermally sealed off. This was put into a corrugated card-board box filled with cushion pieces, and after closing the card-board box, the box was set on a vibration test equipment and was subjected to a vertical vibration of a frequency of 10 Hz at an acceleration rate of 1 G for twenty-four hours.

[0023] Next, the box was brought into a cleanroom where it was opened and the researchers observed that white substance, which was thought to be the antistatic agent, had bled out on the surfaces of the second and the third bags. This substance was also seen to have stuck to the outer surface of the first bag, but the surfaces of the pellicle container inside the first bag was clean of the substance; this was further confirmed when the container was inspected in a dark room

inside the cleanroom, where a 300,000-lux beam lamp was used for the inspection for the foreign matters.

[0024] Also, the container was opened and the product pellicle was inspected in the same manner as stated above, and the surfaces of the product did not show any sign of sticking substance.

Reference Examples 1 and 2

[0025] In Reference Example 1, the first bag and the second bag used were of cleanroom-use grade having a sheet thickness of 70 micrometers, and the third bag used was an antistatic bag having a sheet thickness of 100 micrometers. In Reference Example 2, the first and the second and the third bags used were all of cleanroom-use grade having a sheet thickness of 70 micrometers. Except for these differences, all the particulars of Example 1 were observed in the Reference Examples; thus the openings of the bags were thermally sealed, and after the 24-hour long vibration test, the box and bags were opened in the cleanroom and the container for the product (pellicle) was taken to the dark room in the cleanroom for inspection with the 300,000 lux beam lamp and the result was that in both of the reference examples the amount of foreign substance on the product had increased. This result was entered in Table 1 together with the result from Example 1.

Reference Examples 3 through 5

[0026] In Reference Example 3, all the particulars of Example 1 were observed except that an antistatic bag of a sheet thickness of 70 micrometers was used as the first bag; in Reference Examples 4 and 5, all the particulars of Example 1 were observed except that either or both of the second and the third bags were of cleanroom-use grade (ref. Table 1). The corrugated card-board box was brought into the cleanroom where it was opened and the researchers observed that white substance, which was thought to be the antistatic agent, had bled out on the surfaces of the first and the second and the third bags.

[0027] This substance was also seen to have stuck to the outer surface of the pellicle container. This presence of the white powdery substance on the container was further confirmed when the container was inspected in the dark room inside the cleanroom, where the 300,000-lux beam lamp was used for the inspection for the foreign matter. The container was opened and the product pellicle was inspected in the above-mentioned manner, and there was found foreign material sticking to the pellicle and by means of an infrared microscope spectroscopy the foreign material was identified to be of the same make-up as the antistatic agent engrained in the first bag. This result is entered in FIG. 1.

Comparative Example 1

[0028] This is an example which has been conventionally practiced, wherein only one antistatic bag is used: the pellicle container containing a pellicle was inserted in the antistatic bag of a sheet thickness of 100 micrometers; after sealing the opening of this bag thermally, the same procedure as in Example 1 was followed including the 24-hour vibration test, opening of the box and the bag within the cleanroom, opening of the pellicle container and taking the pellicle out therefrom, and the inspection with the 300,000 lux beam lamp in the dark room inside the cleanroom. This procedure confirmed that there was an increased amount of foreign substance on the product pellicle. This result was also entered in Table 1 together with those of Example and Reference Examples.

TABLE 1

	first bag	second bag	third bag	charging voltage of product	Increase in number of foreign particles on product
Example 1	cleanroom-use bag	antistatic bag	antistatic bag	0 V	0
Reference Example 1	cleanroom-use bag	cleanroom-use bag	antistatic bag	100 V	1
Reference Example 2	cleanroom-use bag	cleanroom-use bag	cleanroom-use bag	450 V	10
Reference Example 3	antistatic bag	antistatic bag	antistatic bag	0 V	5
Reference Example 4	antistatic bag	cleanroom-use bag	antistatic bag	0 V	1
Reference Example 5	antistatic bag	cleanroom-use bag	cleanroom-use bag	0 V	2
Comparative Example 1	antistatic bag	none	none	0 V	3

EXPLANATION OF THE REFERENCE
NUMERALS

- [0029] 1: pellicle
 [0030] 2: pellicle container
 [0031] 3: first bag (of cleanroom-use grade)
 [0032] 4: second bag (antistatic type bag)
 [0033] 5: third bag (antistatic type bag)

What is claimed is:

1. A pellicle storing method comprising steps of placing a container containing a pellicle in a first bag of cleanroom-use grade, closing an opening of said first bag, placing said first bag in a second bag having an antistatic function, closing an

opening of said second bag, placing said second bag in a third bag having an antistatic function, and closing an opening of said third bag.

2. A method as claimed in claim 1, wherein said first bag has been manufactured and preserved in a cleanroom of cleanliness class 1000 or cleaner.

3. A method as claimed in claim 1, wherein said bags having an antistatic function have a surface resistance of 9.9×10^{11} ohm/cm² or lower.

4. A method as claimed in claim 1, wherein said method including bag closing steps are conducted in a cleanroom of cleanliness class 1 or cleaner.

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