

APPARATUS AND METHOD FOR DIRECT TRANSFER OF AN ELECTROLYTICALLY FORMED ANTENNA

Field of the Invention

5 The present invention relates to antennae for transponders. In particular, this invention relates to an apparatus and method for direct transfer of an electrolytically formed antenna onto a substrate.

Background of the Invention

10 Transponders that are mounted onto substrates and used with, for example, product labels or shipping tags are known. Applied onto products, such transponders enable the products to be tracked for various purposes. For example, US Patent 6,140,146 Brady et al, assigned to Intermec IP Corp., describes a process and apparatus for manufacturing RFID transponders in which antennae are formed by a
15 metallized pattern on the surface of a tape.

 Generally, transponders are manufactured that meets specifications in terms of performance and costs. A factor that affects manufacturing costs is manufacturing cycle time. In existing manufacturing processes, such as that described in US Patent
20 6,140,146 Brady et al, cycle time can be improved to reduce the manufacturing costs of transponders. Specifically, antennae associated with such transponders require the antennae to be formed and, thereafter, removed from a support element such as, for example, electrodes in an electrolytic process step. Such antennae are then mounted onto substrates of the transponders in another process step. The time required for the
25 process steps of removing of an antenna from an electrode and mounting the antenna on a substrate can be reduced.

 Furthermore, the above two process steps of removing and mounting exposes the antenna to possible damage or likely contamination. Although additional steps
30 can be implemented to prevent or at least alleviate such damage or contamination,

such additional steps increases cycle time and, consequently, antennae manufacturing costs.

Therefore, a need clearly exists to improve manufacturing cycle time and thereby reduce manufacturing costs of transponders and, particularly, antennas for such transponders.

Brief Description of the Drawings

A preferred embodiment of the present invention will now be more fully described, by way of example, with reference to the drawings of which:

FIG. 1 is a perspective view of an antenna-forming part of an electrode in accordance with the preferred embodiment;

FIG. 2 is a cross-sectional view of the antenna-forming part of the electrode of FIG. 1;

FIG. 3 illustrates a cross-sectional view of a substrate having a mounting compound for mounting the antenna of FIG. 3;

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and

FIG. 4 is a flow chart of a method for direct transfer of the electrolytically formed antenna of FIG. 2 onto a substrate using the electrode of FIG. 1.

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Detailed Description of the Drawings

An apparatus and method for direct transfer of an electrolytically formed antenna onto a substrate in accordance with a preferred embodiment of the invention are described. In the following description, details are provided to describe the preferred embodiment. It shall be apparent to one skilled in the art, however, that the invention may be practiced without such details. Some of these details may not be described at length so as not to obscure the invention.

There are many advantages of the invention. One advantage of the invention is that the electrolytically formed antenna is directly transferred from an electrode of the apparatus onto the substrate without an intermediate step of removing such an antenna from the electrode, whether temporarily or for storage, before mounting onto the substrate.

Consequently, another advantage of the invention is that there is less exposure of the electrolytically formed antenna before mounting to the substrate. Hence, damage to or contamination of the electrolytically formed antenna is less likely or at least alleviated compared to existing processes for manufacturing such an antenna.

Furthermore, direct transfer of the electrolytically formed antenna onto the substrate reduces time required for manufacturing transponder using the apparatus and method of the invention. As a result, cycle time and manufacturing costs are reduced to provide yet another advantage of the invention.

Referring now to FIG. 1 and FIG. 2, an apparatus 10 of the preferred embodiment comprises an electrode 12. An antenna-forming part of the electrode 12 comprises an electroplatable portion 14 for electrolytically forming an antenna (not shown). The electroplatable portion 14 has an adhesion-reducing coating 16 to enable detachment of the antenna onto a substrate. Such a substrate can be applied in transponders that are associated with, for example, product labels or shipping tags.

The adhesion-reducing coating 16 comprises a chromium-based compound. Alternatively, the adhesion-reducing coating 16 can be a titanium-based compound. The electrode 12 further comprises one or more unplated portions 18. The electrode 12 is made using a stainless steel plate with the unplated portions 18 forming an antenna profile. The antenna profile is etched using a photo-mask. The unplated portions 18 are coated with an insulator 20 to prevent electroplating. The insulator 20 can be, for example, an ultra-violet (UV) activated epoxy.

After etching the antenna profile, the electrode 12 is degreased with a degreasing solution and soaked in a sodium hydroxide (NaOH) solution before rinsing with de-ionized water. After de-ionizing, the electrode 12 is then soaked in sulphuric acid (H_2SO_4) solution before immersing in a plating bath. The amount of time the electrode 12 sits in the plating bath depends on the thickness of plating required.

FIG. 3 shows a substrate 30 having a mounting compound 32 for mounting the electrolytically formed antenna. The mounting compound 32 can be, for example, an epoxy resin or an adhesive.

A flowchart of a method 50 for direct transfer of the electrolytically formed antenna onto the substrate 30 is shown in FIG. 4. The method 50 starts at step 51 and proceeds to the step 52 of applying the mounting compound 32 onto an antenna-mounting portion 34 of the substrate 32. The applying step 52 comprises coating the antenna-mounting portion 34 with the mounting compound 32. Amount of the mounting compound 32 that is required depends on dimensions of the electrolytically formed antenna. Generally, a larger antenna requires more mounting compound 32 than a smaller antenna.

The method 50 proceeds to placing the electrode 12 having the electrolytically formed antenna onto the antenna-mounting portion 34 at step 54. In the placing step 54, the electrolytically formed antenna is positioned for mounting at the antenna-mounting portion 34. The placing step 54 comprises pressing the electrode 12 to enable contact of the electrolytically formed antenna with the mounting compound 32.

Finally, removing the electrode at step 56 thereby detaches the electrolytically formed antenna from the electrode 12 onto the antenna-mounting portion 34.

If the mounting compound 32 is a thermoset epoxy resin that needs heat curing, then the method 50 requires a heat-curing step (not shown) for a predetermined time period that depends on formulation of the thermoset epoxy resin. Such a thermoset epoxy resin is typically semi-solid and displays tacky characteristic
5 prior to the placing step 54. The tackiness enables the antenna to be pulled off from the electrode 12 and held at the antenna-mounting portion 34. Heat is then applied to cure the thermoset epoxy resin after the removing step 56.

The present invention therefore provides an apparatus 10 and a method 50 for
10 direct transfer of the electrolytically formed antenna onto the substrate 30 to overcome, or at least alleviate, the problems of the prior art.

It will be appreciated that although one preferred embodiment has been described in detail, various modifications and improvements can be made by persons
15 skilled in the art without departing from the scope of the present invention.



Claims

1. A method for direct transfer of an electrolytically formed antenna onto a substrate, said method comprising the steps of:
 - 5 applying a mounting compound onto at least one antenna-mounting portion of said substrate;
 - placing an electrode having said electrolytically formed antenna onto said at least one antenna-mounting portion, said electrolytically formed antenna being positioned for mounting at said at least one antenna-mounting portion;
 - 10 and
 - removing said electrode to thereby detach said electrolytically formed antenna from said electrode onto said at least one antenna-mounting portion.
2. The method of Claim 1, wherein said applying step comprises the step of
15 coating said at least one antenna-mounting portion with an adhesive.
3. The method of Claim 1, wherein said method comprises the step of coating said at least one antenna-mounting portion with an epoxy resin.
- 20 4. The method of Claim 3, and further comprising the step of curing said epoxy resin.
5. The method of Claim 1, wherein said placing step comprises the step of pressing said electrode to enable contact of said electrolytically formed antenna
25 with said mounting compound.
6. An apparatus for direct transfer of an electrolytically formed antenna, said apparatus comprising:
 - 30 an electrode comprising an electroplatable portion for forming said electrolytically formed antenna, said electroplatable portion having an



adhesion-reducing coating to enable detachment of said electrolytically formed antenna onto a substrate for said direct transfer.

7. The apparatus of Claim 6, wherein said electrode further comprises one or
5 more unplated portions, said one or more unplated portions having an insulator to prevent electroplating.
8. The apparatus of Claim 6, wherein said adhesion-reducing coating comprises a chromium-based compound.
- 10 9. The apparatus of Claim 6, wherein said adhesion-reducing coating comprises a titanium-based compound.
10. A transponder comprising:
15 a substrate having at least one antenna-mounting portion, said at least one antenna-mounting portion having a mounting compound applied thereon;
and
an electrolytically formed antenna, said electrolytically formed antenna being directly transferable from an electrode onto said at least one antenna-
20 mounting portion.
11. The transponder of Claim 10, wherein said mounting compound comprises an epoxy resin.
- 25 12. The transponder of Claim 10, wherein said mounting compound comprises an adhesive.