Claims

1. A method for detecting water vapor intrusion paths in a polymer encapsulated device, characterized in that the method comprises the steps of

- performing a water vapor tracer marker based on a predetermined tracer to be tested for the polymer encapsulated device, obtaining a tracer marker sample;
- performing a secondary ion mass spectrometry analysis on said tracer marker sample to obtain a tracer intensity of said tracer marker sample; and
- determining the path and rate of water vapor intrusion based on said tracer intensity.

2. The method according to claim 1, characterized in that said water vapor tracer labelling based on a predetermined tracer to be measured for the polymer encapsulated device, obtaining a tracer labelled sample, further comprising:

- establishing a predetermined tracer marking environment;
- marking water vapor intrusion paths of said polymer encapsulated device to be tested based on said predetermined tracer marking environment; and
- determining said tracer marker sample based on said path marking results.

3. The method according to claim 2, characterized in that said predetermined tracer tagging environment comprises: tagging environment temperature, tagging environment relative humidity and tagging duration.

4. The method according to claim 1, characterized in that said determining the path and rate of water vapor intrusion based on said tracer strength, further comprising:

- obtaining a marker duration for which the water vapor tracer marking process lasts; and
- determining the path and rate of water vapor intrusion based on said tracer intensity versus said marker duration.

5. The method according to claim 4, characterized in that said determining the path and rate of water vapor intrusion based on said tracer strength with said marker duration, further comprising:

- determining tracer invasion distance and invasion path based on said tracer strength.
- establishing a target infiltration curve based on said tracer invasion distance versus said marker duration determining the rate of water vapor intrusion based on said target infiltration curve.

6. the method according to claim 1, characterized in that said secondary ion mass spectrometry of said tracer-labelled sample is performed to obtain the tracer intensity of said tracer-labelled sample, further comprising:

- obtaining at least one tracer detection signal of said tracer marker sample using secondary ion mass spectrometry;
- determining the location of water vapor intrusion and tracer intensity in said tracer marked sample based on said tracer detection signal; and
- wherein said tracer detection signal corresponds one-to-one with said water vapor intrusion location.

7. The method according to any one of claims 1 to 6, characterized in that, prior to performing secondary ion mass spectrometry on said tracer marker sample, further comprising a step of applying a surface conductive thin film coating to said tracer label sample.

8. The method according to any one of claims 1 to 6, characterized in that said predetermined tracer comprises deuterium or deuterium oxide.

9. An encapsulation device water vapor intrusion path detection device, comprising:

- a tagging module for obtaining a tracer tagging sample based on a predetermined tracer for water vapor tracer tagging of a package device to be tested;

- a mass spectrometry analysis module for performing secondary ion mass spectrometry analysis on said tracer marker sample to obtain the tracer intensity of said tracer marker sample; and
- a data processing module for determining the path and rate of water vapor intrusion based on said tracer intensity.

10. The detection device according to claim 9, characterized in that said pre-defined tracer in the marking module is in gaseous or liquid form.

Claims

1. A method for detecting a water vapor intrusion path of a packaged device, comprising following steps:

- with a predetermined tracer, a water vapor tracer mark is carried out on the packaged device to be tested, and the tracer mark sample is obtained;
- performing secondary ion mass spectrometry analysis on the tracer mark labelled sample to obtain the tracer intensity of the tracer marker labelled sample;
- determining the path and speed of water vapor intrusion according to the tracer intensity;
- the water vapor intrusion path is determined according to the tracer intensity at different positions of the sample, and the water vapor intrusion speed is determined according to the time required for the tracer to reach different positions of the sample;
- determining the water vapor intrusion path according to the tracer intensity at different positions of the sample, comprising: obtaining the tracer detection signal of any target point of the tracer-marked sample, and determining the indication of the target point according to the numerical value of the tracer detection signal; if the tracer intensity of any marking time and any target point exceeds the predetermined concentration threshold, it is determined that the tracer penetrates into the point after the current marking time, and the target point is determined as the sample passes through the water vapor intrusion position corresponding to the current marked duration.

2. The method according to claim 1, wherein the water vapor trace marking is carried out on the packaged device to be tested based on the predetermined tracer, and the trace mark sample is obtained, comprising:

- establishing a default tracer marking environment;
- marking the water vapor intrusion path of the packaged device under test based on the predetermined trace marking environment;
- the tracer-marked samples are determined according to the path-marker results.

3. The method according to claim 2, wherein the predetermined trace marking environment comprises: marking environment temperature, marking environment relative humidity and marking duration.

4. The method according to claim 1, wherein said determining the path and speed of water vapor intrusion according to the intensity of said tracer comprises:
obtaining the marking duration of the water vapor tracer marking process;
wherein the path and speed of water vapor intrusion are determined according to the intensity of the tracer and the duration of the marking.

5. The method according to claim 4, wherein the determining the path and speed of water vapor intrusion according to the tracer intensity and the marking duration comprises:

- determining the tracer invasion distance and invasion path according to the tracer intensity;
- establishing a target penetration curve according to the tracer invasion distance and the marking duration;

- the water vapor intrusion velocity is determined according to the target infiltration curve.

6. The method according to claim 1, wherein said carrying out secondary ion mass spectrometry analysis on said tracer-labelled sample to obtain the tracer intensity of said tracer-labelled sample comprises:
   - obtaining at least one tracer detection signal of the tracer-labelled sample by secondary ion mass spectrometry;
   - determining the water vapor intrusion location and tracer intensity in the tracer-marked sample according to the tracer detection signal;
     wherein, the tracer detection signal is in one-to-one correspondence with the water vapor intrusion location.

7. The method according to any one of claims 1~6, characterized in that, before performing secondary ion mass spectrometry analysis on the tracer labelled sample, the method further comprises carrying out the surface conductive thin film coating treatment on the tracer mark sample.

8. The method according to any one of claims 1~6, wherein the predetermined tracer comprises deuterium or deuterium oxide.

9. A water vapor intrusion path detection device for a packaged device, characterized in that the device comprises:
   - a marking module is used to perform water vapor trace marking on the packaged device to be tested based on a predetermined tracer, and obtain trace mark samples;

- a mass spectrometry module, configured to perform secondary ion mass spectrometry analysis on the tracer-labelled sample, to obtain the tracer intensity of the tracer-labelled sample;
- a data processing module, configured to determine the path and speed of water vapor intrusion according to the intensity of the tracer;
- the water vapor intrusion path is determined according to the tracer intensity at different positions of the sample, and the water vapor intrusion speed is determined according to the time required for the tracer to reach different positions of the sample;
- determining the water vapor intrusion path according to the tracer intensity at different positions of the sample, comprising: obtaining the tracer detection signal of any target point of the tracer-marked sample, and determining the indication of the target point according to the numerical value of the tracer detection signal; if the tracer intensity of any marking time and any target point exceeds the predetermined concentration threshold, it is determined that the tracer penetrates into the point after the current marking time, and the target point is determined as the sample passes through the water vapor intrusion position corresponding to the current marked duration.

10. The detection device according to claim 9, characterized in that, the pre-defined tracer in the marking module is gaseous or liquid.