Application of Modern Chromatographic Analysis Technology in Coating Detection

The Advancement of Modern Chromatographic Technology in Coatings Testing

Coating composition detection is one of the basic work of coating production optimization. The main functions of modern analysis and testing of coatings are as follows:

➢ Efficiently understand the specific ingredients in the coating, the content of each ingredient, and the ratio of the different ingredients.
➢ It is beneficial to the further research and development of high-performance coatings, and a more scientific composition combination of coatings can be obtained through composition detection.
➢ It is helpful to strengthen the research on the composition of advanced coatings, through understanding and innovation, to carry out the research and development of new coatings.
➢ Improve the scientific degree of coatings separation analysis during component analysis, and efficiently separate complex mixtures until the detection purity of the coating can meet the equipment requirements of the corresponding instrument.

➢ It helps to control the proportion of coatings components lost during the entire inspection process, thus optimizing the process control of the entire coatings inspection.

➢ Modern chromatographic analysis technology has high reproducibility and recovery rate, which can carry out detailed analysis of trace components in the coatings, so as to achieve flow control of the monitored substances throughout the detection process.

Characteristics of Modern Chromatographic Analysis Technology

The modern chromatographic analysis technology mainly refers to the separation of material component structure under the condition of high-speed operation of the internal components of the test object. This separation method is relatively efficient, and the technician can use the speed control method to optimally control the different components contained in the test material.

In fact, compared with the traditional coatings detection methods, modern chromatographic analysis technology has more advantages in speed analysis, speed control, separation degree and separation effect. Especially in the process of composition detection of small particles, modern chromatographic technology can be used to detect components with different peak widths. The blockage of the chromatographic column is effectively avoided and the scientificity of the whole detection is improved.

In the production process of modern coatings, it usually contains a variety of harmful substances and highly toxic substances. Chromatographic detection technology can greatly improve the efficiency of the whole testing work by separating the components of these substances.

The Specific Application of Modern Chromatographic Analysis Technology

The fluidity of the coating is usually high, the application of traditional detection technology may cause the loss of the tested object. With the application of modern chromatographic detection technology, the loss rate of the tested coatings can be better controlled by the combined application of gas chromatography and liquid chromatography. Technicians can also optimize the detection of coatings of different compositions by using the ultra-high separation performance of chromatographic detection methods, combined with distillation technology, extraction technology, centrifugal technology, *etc*., further reducing the cost of detection and improving the efficiency of detection.

➢ **Gas Chromatography Detection Technology**

Gas chromatography detection technology is a major chromatographic detection method, which has high stability. It can complete the separation of the tested coatings by quantitative analysis and qualitative analysis. At the same time, this detection technology has a very high separation efficiency and a short separation time. It can be applied to many types of coatings. In addition, it can also be used in drug inspection and analysis, especially in excipient analysis and environmental quality testing.

First, gas chromatography is used to detect coating components. The separation of polymer emulsion materials, residual substances and free substances is accomplished by large gas chromatography detector.

Second, the technician prepares the coating object to be tested and adds a solvent to the coating to determine the water content and oily content of the coating.

Third, technicians should control the recovery rate of gas chromatographic detection methods. Taking the detection of tribenzene content as an example, the recovery amount can usually reach 98% to 101%. It can be seen that the recovery rate of gas chromatography is relatively high, and the tribenzene content in the coating can be detected effectively.

➢ **Liquid Chromatographic Detection Technology**

- Technology Advantages

  Liquid chromatography detection technology is also one of the main chromatographic detection technology, modern liquid chromatography detection technology is very efficient, and can be combined with mass spectrometry, spectrum, and nuclear magnetic resonance detection technology. In this way, technicians can effectively analyze the polymers in the coating materials, and even find some unknown detection objects. The whole detection does not need the standard sample, it can directly carry on the qualitative analysis through the pyrolysis fragment of the coating, to determine the boiling point, melting point, component mixing of the tested coating by analyzing and judging the polymer composition and structure.

- Future Development

  High-performance liquid chromatography detection technology is very convenient, and the detection results are relatively accurate. The technician can pre-process the whole sample through micro-additive control to optimize the quantitative analysis result of the whole detection. In the future, technicians will optimize high performance liquid chromatography detection technology, through the combination with other polymer detection and analysis results, to overcome the problem that inorganic fillers cannot be reduced in the process of sample detection, so as to further improve the detection effect and realize the optimal control of coating detection.

➢ **Mass Spectrometry Detection Technology**

- Technology Advantages

  The pyrolysis chromatography method is very suitable for coatings testing with short decomposition time and high ambient temperature. In such an environment, many coatings are affected by high temperatures, and are broken down into small molecular fragments of different connection conditions. These small molecular fragments often contain different coating component information, and the polymer chain structure is

relatively complicated. Therefore, the optimal rendering of the whole pyrolysis chromatographic fingerprint can be realized by using mass spectrometry detection technology to mine the information of these fragments. The technician should grasp the maximum and minimum values of the whole detection process and perform quantitative analysis through the detection method of high-efficiency capillary column. The signal in the whole mass spectrometry process is received in real time, and the total ion precipitation of the detected coating material is optimally controlled, and the target compound content in the detected coating material is calculated by measuring the peak value.

- Technology Application

This technology can realize the separation of the tested coating through the dissolution and melting of the tested coating, and reduce the difficulty of dissolution and melting of organic matter in the coating. From a practical point of view, this detection method is very suitable for the detection of resins and other materials, these materials have cross-linking curing, through the traditional detection method is very difficult to separate.

First of all, technicians can analyze the composition of some polymer resin structure in the coating, control the quality through some subtle changes of the molecular chain structure, and study the structure of high polymer materials with resin structure.

Secondly, technicians can quantitatively analyze the fracture of the entire polymer chain, grasp the energy generated by the entire polymer chain, and heat it to achieve the optimization of the composition by controlling the fission temperature.

Finally, technicians have to observe whether the fission process of the tested coating is complete at low temperature. If the tested coating is a high boiling point compound, it is difficult to separate it by chromatographic detection technology. In such cases, mass spectrometry techniques are further used to control the composition of hydrogen-based low molecular compounds contained in the coating.

➢ **High Performance Liquid Chromatography Detection Technology**

- Technology principle

High performance liquid chromatography (HPLC) detection technology is developed on the basis of the original liquid phase detection technology and gas phase detection technology, which is very suitable for coatings with high fluidity. Generally speaking, the HPLC detection method can effectively decompose the coatings with high boiling point, medium molecular weight and easy decomposition in high temperature environment. At the same time, the application of this technology can also control the content of hydroxyl compounds and ionic inorganic compounds in the tested coatings, and qualitatively analyze the specific organic components of the tested coatings by the means of comparative analysis.

- Future Development

From the current production and analysis of coatings, many coatings have molecular masses greater than two thousand. This organic compound is very suitable for analysis using a HPLC detector. It can be seen from the overall statistical data of the laboratory that, at present, the effective rate of coating detection with this HPLC technology can be more than 90%. For example, nitrocellulose coatings, phthalate ester compounds, and relatively toxic coatings are mainly detected by this HPLC detection technique.

Summary

Chromatographic detection technology has many advantages in coating detection, which can be combined with a variety of detection techniques, so as to improve the science and effectiveness of detection.

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