

ICS 83.080.20

CCS G 31

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**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

SH/T 1826-2019

**Plastics-Determination of melting enthalpy and crystallinity and melting
temperature of ultra-high molecular weight polyethylene (PE-UHMW) materials
and products Differential scanning calorimetry (DSC)**

塑料 超高分子量聚乙烯(PE-UHMW)材料和制品熔融焓和结晶度及熔融温度的测
定 差示扫描量热法 (DSC)

(English Translation)

Issued on: December 24, 2019

Implemented on: July 1, 2020

Issued by: Ministry of Industry and Information Technology

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This standard was proposed by China Petrochemical Corporation.

This standard is under the jurisdiction of the Petrochemical Plastic Resin Products Branch of the National Plastics Standardization Technical Committee (SAC/TC15/SC1).

The organization responsible for drafting this standard. Beijing Yanshan Petrochemical High-Tech Technology Co., Ltd.

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1 Scope

This standard specifies the Differential Scanning Calorimetry (DSC) method for the determination of the enthalpy of fusion of ultra-high molecular weight polyethylene (PE-UHMW) materials and products, Test method for melting temperature. And the calculation method of crystallinity.

This standard applies to powders, molded materials, finished products or used PE-UHMW. Also suitable for irradiated or chemically cross-linked PE-UHMW.

2 Normative references

The following documents are indispensable for the application of this document. All dated reference documents. Only the dated version applies to this article Pieces. All undated reference documents. The latest version (including all amendments) is applicable to this document.

GB/T 2035 Plastic Terms and Definitions GB/T 19466.1-2004 Plastic Differential Scanning Calorimetry (DSC) Part 1: General GB/T 19466.3-2004 Plastic Differential Scanning Calorimetry (DSC) Part 3: Melting and crystallization temperature and enthalpy Determination

3 Terms and definitions

The following terms and definitions defined in GB/T 2035, GB/T 19466.1-2004 and 19466.3-2004 apply to this document.

Degree of crystallinity the mass fraction of the crystalline phase in a semi-crystalline polymer. XC. The unit is expressed as a percentage (%).

4 Method summary

Put a known mass of PE-UHMW in the sample dish. Heat to the melting end temperature at a certain heating rate under protective gas Degree above. Record the melting temperature curve. Simultaneously measure the heat flow of the sample vessel and the blank reference vessel. The area enclosed by the melting peak curve and the baseline Represents the enthalpy of fusion. The sample quality is used for normalization. Then use the theoretical melting enthalpy of 100% crystalline polyethylene for normalization. which is Obtain the crystallinity of the sample.

5.1 Differential scanning calorimeter

See GB/T 19466.1-2004 5.1.

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5.2 Sample dishes

Aluminum DSC sample pan. Used to hold the sample and reference sample. Press the lid on the sample dish. And made of the same material of the same quality. Is measuring Condition. The sample cuvette does not physically or chemically change with the sample and atmosphere.

5.3 Analytical balance

Weighing accuracy. $\pm 0.01\text{mg}$.

Note: When using a balance with an accuracy of 0.01 mg. The repeatability standard deviation of polyethylene fusion enthalpy is 1.2% [1].

5.4 Standard sample

See Appendix A of GB/T 19466.1-2004. Use standard samples of indium and tin.

5.5 Air source

Nitrogen or other inert gases. The purity is at least 99.9%.

6 Specimen

6.1

The PE-UHMW sample can be powder or fine particles. It can also be fragments of films or flakes. Recommended fine particle size or fragment thickness the degree is not more than 0.25mm.

6.2

The machining process will affect the crystal structure of the material. If sampling from a large piece of PE-UHMW sample. It is recommended to use clean and sharp A blade or other similar tool to cut thin slices. Tools that can generate heat to melt PE-UHMW should not be used to cut samples. Holes can also be used the drill or puncher cuts the sample from the PE-UHMW film.

6.3

The sample should be flat. Ensure good contact with the sample cuvette.

6.4

It is recommended to take at least three samples from each test position for testing.

Note: The location in the sample where DSC analysis is required is defined as the "test location".

7 Test conditions and state adjustment of samples

See Chapter 7 of GB/T 19466.1-2004.

8 Calibration

See Chapter 8 of GB/T 19466.1-2004.

9.1 Instrument preparation

9.1.1

Before the test. Power on the instrument. Make it balanced for at least 30min.

9.1.2

Place two empty sample dishes with the same mass on the sample holder. Adjust to the actual measurement conditions. At the required temperature Within range. The DSC curve should be a straight line. When you can't get a straight line. Record the DSC curve after confirming the repeatability.

9.1.3

During the entire test. The DSC test chamber should be filled with dry nitrogen or other inert gases. Flow at 50mL/min $\pm$ 5mL/min Purge at speed. And all calibrations and tests should use the same gas and purge rate.

9.2 Placement of the sample

9.2.1

Select a sample vessel with an appropriate volume. And make sure it is clean.

9.2.2

Use two identical sample dishes. One is used as a sample cuvette. (Sample cuvette where the sample is placed). The other serves as a reference cuvette (without placing the sample Sample dish) ?

9.2.3

Weigh the sample vessel and lid. Accurate to 0.01 mg.

9.2.4

Place the sample in the sample cuvette. Seal the sample dish with the lid. Check the bottom