

ICS 13.030.50

CCS Z 05



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

GB/T 43752-2024

**Recovery and treatment method of crystalline silicon
photovoltaic modules - Physical method**

晶体硅光伏组件回收处理方法 物理法

Issued on: March 15, 2024

Implemented on: October 1, 2024

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

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1 Scope

The document specifies the terms and definitions, the overview, the treatment conditions, the equipment, the samples, the treatment of the modules, the mass recovery rate and the management for the recovery and treatment of crystalline silicon photovoltaic modules based on the physical method.

It applies to the recovery and treatment of crystalline silicon photovoltaic modules based on the physical method. The recovery and treatment of other types of photovoltaic module based on the physical method may refer to it.

2 Normative references

The content of the documents listed below constitutes indispensable provisions of this document through normative reference in the text. For dated references, only the edition corresponding to that date applies; for undated references, the latest edition, including all amendments, applies.

GB 8978-1996 Integrated wastewater discharge standard; GB 12348-2008 Emission standard for industrial enterprises noise at boundary; GB 16297-1996 Integrated emission standard of air pollutants; GB 18599-2020 Standard for pollution control on the storage and landfill of general industrial solid wastes; GB/T 23685-2009 General technical requirements

for the recovery and utilization of waste electrical and electronic products; GB/T 39753-2021 General technical requirements for the recycling and reuse of photovoltaic modules; HJ 364-2022 Technical specification for pollution control of waste plastics.

3 Terms and definitions

The terms and definitions given in GB/T 39753-2021 and the following apply to this document.

3.1 collect: activity of gathering, sorting and arranging photovoltaic modules. Source: GB/T 39753-2021, 3.3.

3.2 storage: activity of temporarily placing photovoltaic modules in a specific site meeting the requirements, for the purpose of collection, transport, treatment and disposal. Source: GB/T 39753-2021, 3.4.

3.3 take-back: activity of collecting and storing photovoltaic modules.

3.4 disintegrate: activity of dismantling and taking apart photovoltaic modules by manual or mechanical means, in order to facilitate treatment. Source: GB/T 39753-2021, 3.5, modified.

3.5 treatment: activity of decontaminating, disintegrating and crushing photovoltaic modules and their component parts and of recycling them. Source: GB/T 39753-2021, 3.10, modified.

3.6 disposal: activity of using incineration, landfill or other methods that change the physical, chemical or biological characteristics of photovoltaic modules and their component parts so as to reduce their quantity or eliminate their harmfulness, or activity of finally placing photovoltaic modules and their component parts in a site or facility meeting environmental protection requirements. Source: GB/T 39753-2021, 3.11, modified.

3.7 terminal: component part that leads the direct current out of the photovoltaic lamination (3.8). Note: the terminal includes the junction box, the photovoltaic direct current cable, the cable connector and the like. Source: GB/T 38785-2020, 3.2.

3.8 photovoltaic lamination: semi-finished photovoltaic module in which the encapsulation of the cells is complete but the junction box, the lead wires and the frame have not yet been fitted, made by bonding two or more layers of the same or different materials. Source: GB/T 39753-2021, 3.12, modified.

3.9 recycling: process of treating photovoltaic modules so that they can be used again as raw material. Note: recycling does not include the recovery and use of energy. Source: GB/T 39753-2021, 3.7, modified.

3.10 recovery rate: ratio of the mass of the photovoltaic module before and after recovery and treatment.

4 Overview

4.1 The valuable materials in crystalline silicon photovoltaic modules, called photovoltaic modules in the rest of the text, namely the aluminium frame, the junction box, the photovoltaic direct current cable, the glass, the backsheet, the encapsulant film, the ribbon and busbar and the cells, are separated and recovered by manual or mechanical physical means.

4.2 The physical method treats each part of the photovoltaic module structure, shown by dashed boxes in Figure 1 of the document; the main treatment flow, shown by solid boxes in the same figure, comprises pretreatment, frame treatment, terminal treatment, glass treatment, backsheet treatment, encapsulant film treatment, ribbon and busbar treatment and cell treatment, so that the separated materials can be recycled as resources. The structural diagram of the photovoltaic module is given in Annex A and the guidance diagram of the physical treatment in Figure 1.

5 Treatment conditions

5.1 When the recovery and treatment equipment treats photovoltaic modules, the indoor ambient temperature shall be controlled between -10 °C and 50 °C.

5.2 When the recovery and treatment equipment treats photovoltaic modules, the indoor ambient relative humidity shall be controlled between 30 % and 70 %.

5.3 When the recovery and treatment equipment treats photovoltaic modules, the indoor ambient light intensity shall be controlled between 1 000 W per square metre and 2 000 W per square metre. The quantity, its unit and its range are reported here as printed; see the note at the end of this record.

5.4 When the recovery and treatment equipment treats photovoltaic modules, the indoor ambient pressure shall be controlled between 101.3 kPa and 110 kPa.

5.5 The waste water and the noise produced while the recovery and treatment equipment treats photovoltaic modules shall be treated; the discharge of the various pollutants in the waste water shall conform to GB 8978-1996 and the various noise emissions shall conform to GB 12348-2008.

6 Equipment

6.1 The main equipment includes the sorting device, the cleaning device, the drying device, the frame disintegrating device, the terminal shovelling device, the hot knife separating device, the high pressure grinding device, the wire cutting equipment, the thermal oscillation device, the mechanical crushing device, the screening equipment and the mechanical peeling device.

6.2 Sorting device: used to sort photovoltaic modules; its main feature is that it classifies and arranges the modules according to their degree of integrity, model, structure and other properties.

6.3 Cleaning device: used to clean impurities and contaminants from the surface of photovoltaic modules; its main feature is that it washes the module surface by water flushing, spraying and similar means.

6.4 Drying device: used to dry the cleaned photovoltaic modules; its main feature is that it accelerates the drying of the module surface by hot air, hot gas flow and similar means.

6.5 Frame disintegrating device: used to disintegrate and separate the frame structure of photovoltaic modules; its main feature is that it disintegrates and separates the frame by acting on a single side, on opposite sides or on the diagonal.

6.6 Terminal shovelling device: used to remove the terminal part of photovoltaic modules; its main feature is that it separates the terminal part by shearing, cutting and similar separating operations.

6.7 Hot knife separating device: used to separate the glass of the photovoltaic lamination; its main feature is that it separates the glass of the lamination by the hot knife principle, through high temperature cutting, hot melting and similar techniques.

6.8 High pressure grinding device: used to separate the materials of the photovoltaic lamination; its main feature is that it grinds the backsheet, encapsulant film, cells, ribbon and busbar and glass of the lamination into the required state by high pressure grinding, crushing and similar techniques.

6.9 Wire cutting equipment: used to separate the materials of the photovoltaic lamination; its main feature is that it divides the backsheet, encapsulant film, cells, ribbon and busbar and glass of the lamination into the required state through the rapid movement of a fine wire cutting the material.

6.10 Thermal oscillation device: used to separate the materials of the photovoltaic lamination; its main feature is that it separates the backsheet, encapsulant film, cells, ribbon and busbar and glass of the lamination by heat conduction, oscillation and similar techniques.

6.11 Mechanical crushing device: used to separate the materials of the photovoltaic lamination; its main feature is that it separates the backsheet, encapsulant film, cells, ribbon and busbar and glass of the lamination by mechanical crushing, separation and similar techniques.

6.12 Screening equipment: used to screen the crushed and separated materials of the photovoltaic lamination; its main feature is that it separates the backsheet, encapsulant film, cells, ribbon and busbar and glass of the lamination through grading, separation, sorting