ICS 83.080.20
CCS G 32

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 40006.11-2024

Plastics - Recycled Plastics - Part 11: Polyvinyl chloride (PVC) materials

塑料 再生塑料 第11部分：聚氯乙烯(PVC)材料

Issued on: September 29, 2024 **Implemented on: April 1, 2025**

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

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3 Terms and definitions

The terms defined in GB/T 40006.1-2021, GB/T 2035 and GB/T 30102 apply, together with one term defined here.

3.1 unplasticized poly(vinyl chloride), PVC-U: poly(vinyl chloride) containing no plasticizer. A note states that plasticizer in poly(vinyl chloride) does not include additives such as stabilizers and lubricants. The definition is cited from GB/T 2035-2024, 3.1400.

4 Classification and designation

Designation and classification follow GB/T 40006.1-2021.

Recycled poly(vinyl chloride) plastics are divided into two classes: unplasticized recycled poly(vinyl chloride), PVC-U (REC), whose characteristic properties are Vicat softening temperature and density; and plasticized recycled poly(vinyl chloride), PVC-P (REC), whose characteristic properties are Shore hardness and density.

Designation is made on the nominal values of the characteristic properties. The nominal Vicat softening temperature is taken to two significant figures and placed after the letter of test condition type B (B50). The nominal density is rounded at the second decimal place and the first two digits are kept. The nominal Shore hardness is taken to two significant figures and placed after the letter of the durometer type, A (Shore A) or D (Shore D).

Two worked examples are given. Example 1 designates an unplasticized recycled material

sourced from industrial articles, grey, powdered, containing powdered calcium carbonate filler, intended for extruded profiles, with a nominal Vicat softening temperature of 83 degrees Celsius and a nominal density of 1.44 grams per cubic centimetre. Example 2 designates a plasticized recycled material sourced from everyday household articles, black, pelletized, containing calcium carbonate filler of unstated form, intended for injection moulded articles, with a nominal Shore A hardness of 66 and a nominal density of 1.39 grams per cubic centimetre. Each example is laid out over a designation block of the national standard number, the characteristic property group and five character groups, of which only the second is mandatory, and each is followed by a short form of the designation.

5 Requirements

5.1 General requirement: the material shall be uniform, free of foreign matter and without visible colour difference.

5.2 Identification of the base material: the base material shall be poly(vinyl chloride). Identification is by infrared spectroscopy, and the infrared spectra of both PVC-P (REC) and PVC-U (REC) shall show the characteristic absorption peaks of poly(vinyl chloride) resin. Typical transmission infrared spectra are given in Annex A.

5.3 Odour grade shall meet 5.3 of GB/T 40006.1-2021. 5.4 Restricted substances: heavy metal content shall meet Table 6 of GB/T 40006.1-2021, and polybrominated biphenyls and other organic substances shall meet Table 7 of that document. 5.5 Radioactive substances shall meet 5.5 of GB/T 40006.1-2021.

5.6 Suitability of the processing method: after calendering, the surface of the sheet shall be smooth and free of unmelted particles, holes and fibres visible to the naked eye; after extrusion, the surface of the extrudate shall be smooth and free of the same defects.

5.7 Appearance and properties shall meet Table 1, and a note refers to Annex B for further properties. Table 1 has an item column and three requirement columns, for PVC-U (REC),X, for PVC-P (REC) and for PVC-P (REC),X, where X is the ash percentage of a filled material as designated under GB/T 40006.1-2021; the twelve rows and the three columns reconcile.

Table 1, read row by row. Pellet appearance, large and small particles, in grams per kilogram, maximum: not specified for PVC-U (REC),X, and 40 for both plasticized columns. Ash, per cent: not more than 30, not more than 2, and 2 to 30 respectively. Volatiles including water, per cent, maximum: 1 in all three columns. Flowability, in seconds: uniform flow in all three columns, with a footnote requiring the test conditions, data and observations to be reported. Apparent density, in grams per millilitre, minimum: 0.38 for PVC-U (REC),X only. Density, in grams per cubic centimetre: the nominal values M1, M2 and M3 of the three materials respectively. Density deviation, in grams per cubic centimetre:

plus or minus 0.005 in all three columns. Vicat softening temperature, degrees Celsius, B50, minimum: 70 for PVC-U (REC),X only. Hardness Shore D: report for all three columns. Hardness Shore A: not specified for PVC-U (REC),X, report for the two plasticized columns. Tensile strength, in megapascals, minimum: 29, 5 and 8 respectively. Nominal strain at tensile break, per cent, minimum: not specified for PVC-U (REC),X, 150 and 80 for the two plasticized columns. A footnote adds that where the A durometer reads above 90 the D durometer is used, and where the D durometer reads below 20 the A durometer is used.

6 Test methods

6.1 Rounding of test results follows GB/T 8170. 6.2 Conditioning follows GB/T 2918 unless the test method says otherwise, at a temperature of 23 degrees Celsius plus or minus 2 degrees Celsius, a relative humidity of 50 per cent plus or minus 10 per cent, and for at least 16 hours; testing is carried out in the same standard atmosphere.

6.3 Specimen preparation. Before compression moulding, PVC-U (REC) and PVC-P (REC) are pre-plasticized on a two-roll mill under the conditions of Table 2 and Table 3 respectively; powdered PVC-U (REC) and pelletized PVC-P (REC) may also be moulded after adequate pre-plasticization by another suitable method. The milled sheet is then cross-laid into a preheated mould and compression moulded to GB/T 9352 under the conditions of Table 4 and Table 5.

Tables 2 to 5 are laid out with merged cells that the extraction has run together, so the numbers are not reported here. Table 2 fixes, for all grades of PVC-U (REC), the roll surface temperature, milling time, roll surface speed, friction ratio, nip gap, and the recommended roll diameter and roll width. Table 3 fixes the same set of columns for PVC-P (REC), banded by Shore hardness, with the mill temperature varying between the bands and the other columns common to all of them. Table 4 fixes, for all grades of PVC-U (REC), the moulding temperature, average cooling rate, demoulding temperature, full pressure and its holding time, and preheating pressure and its time; a note to that table gives the typical moulding temperature as 170 degrees Celsius to 185 degrees Celsius. Table 5 fixes the same columns for PVC-P (REC), again banded by Shore hardness, and a note adds that very soft PVC-P (REC) may need a lower demoulding temperature.

6.4 General examination is by visual inspection. 6.5 Identification of the base material follows the infrared method of Annex B of GB/T 40006.1-2021; films of PVC-U (REC) and PVC-P (REC) are pressed at 180 degrees Celsius, with a recommended film thickness of 20 micrometres to 40 micrometres, and are scanned at a resolution of 4 reciprocal centimetres with at least 32 scans.

6.6 to 6.8 refer odour grade, heavy metals, polybrominated biphenyls and other organic substances, and radioactive substances back to the corresponding clauses of GB/T 40006.1-2021. 6.9 refers calendering to Annex F and extrusion to Annex G of GB/T 35262-2017.

6.10 Appearance and properties. Pellet appearance follows SH/T 1541.1. Ash follows GB/T 9345.5 by direct ignition at 950 degrees Celsius. Volatiles including water follow GB/T 2914-2008, with method A as the referee method, on a 5 gram specimen heated at 110 degrees Celsius for 1 hour and then measured. Flowability follows GB/T 21060 and apparent density GB/T 1636. For density, specimens of 20 millimetres by 20 millimetres by 4 millimetres, or another suitable size, are machined or punched from the moulded sheet under GB/T 39812 and tested to GB/T 1033.1 with the immersion method as referee; the density deviation is the difference between the test result and the nominal value of the sample. Vicat softening temperature is measured on the same specimen size to GB/T 1633 at a heating rate of 50 degrees Celsius per hour under a 50 newton load (B50). Hardness is measured to GB/T 2411 on square specimens of at least 50 millimetres by 50 millimetres, or round specimens of at least 50 millimetres diameter, at least 4 millimetres thick: Shore D for PVC-U (REC), and Shore A or Shore D for PVC-P (REC). Tensile strength and nominal strain at tensile break are measured on type A2 specimens of GB/T 37426-2019 to GB/T 1040.2-2022 at a test speed of 50 millimetres per minute.

7 Inspection rules

7.1 Inspection is divided into factory inspection and type inspection. Factory inspection of PVC-U (REC) shall include at least ash, volatiles including water, apparent density, Vicat softening temperature and density. Factory inspection of PVC-P (REC) shall include at least pellet appearance, ash, volatiles including water, Shore hardness and density.

All items of Clause 5 are type inspection items. Type inspection shall be carried out on trial production and type approval of a new product; after regular production has started, when a material change of raw material or process may affect product properties; when production resumes after overhaul of the plant; when factory inspection results differ appreciably from the last type inspection; on first import of a product or after twelve months of continuous production; and in any other case where type inspection is needed.

7.2 Batching and sampling. A batch is formed from product of the same grade made on the same line from the same raw material by the same process; the works may also batch by a given production period or by storage silo. Product is inspected and accepted batch by batch. A first note lists declared batches, production batches and inspection batches; a second note states that imported recycled plastics are generally batched by the declared product batch number, one number to a batch, or by another prescribed method. Sampling may be taken at the silo sampling point or set from the production cycle and other practical conditions; sampling of packaged product follows GB/T 2547.

7.3 Decision and retest rules. The material is inspected under Clause 6, judged against the requirements of Clause 5, and a certificate is issued. If an item fails, that item may be retested on a fresh sample drawn from the same batch with twice the number of sampling units, and the retest result is the basis for judging the batch.