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**Additive manufacturing - Specification for material
extrusion process of plastic materials**

增材制造 塑料材料挤出成形工艺规范

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Additive manufacturing - Specification for material extrusion process of plastic materials

1 Scope

This Standard specifies classification and grade, materials, equipment, specimen preparation, forming process, conformity certification documents, inspection and technical data delivery for extrusion process of additive manufacturing plastic materials.

This Standard is applicable to extrusion process of plastic materials. The extrusion process of other materials can also refer to this Standard.

NOTE: Plastic materials include unfilled, filled, and special additives (such as flame retardants, stabilizers) plastics and their composite materials that are suitable for processing into parts.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 2035, *Terms and definitions for plastics*

GB 4943.1, *Information technology equipment -Safety - Part 1: General requirements*

GB/T 5226.1, *Electrical safety of machinery - Electrical equipment of machines - Part 1: General requirements*

GB 14554, *Emission Standards for Odor Pollutants*

GB/T 35022, *Additive manufacturing - Main characteristics and corresponding test methods - Parts and powder materials*

GB/T 35351, *Additive manufacturing - Terminology*

GB/T 39329, *Additive manufacturing - Test methods - Precision inspection of standard test artifacts*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 2035, GB/T 35351 as well as the followings apply.

3.1 filament

Continuous filamentary plastic material.

NOTE: Usually it is evenly wound on spools for storage.

3.2 granule

Small plastic pellets of various sizes and shapes made by cutting, grinding, crushing, precipitation and polymerization operations.

NOTE: In these operations, powdery substances will also be obtained. In some precipitation and polymerization processes, bead-like substances can be produced.

3.3 extrusion nozzle

A material extrusion device with heating function.

3.4 support

During the forming process, a temporary auxiliary substrate bearing structure that is provided for the printed layer of the part.

NOTE 1: The support is usually removed from the part before use.

NOTE 2: The support material can be different from the part material and deposited from a different nozzle.

3.5 tool path

The movement path of the extrusion nozzle during the forming process.

NOTE: It is usually divided into two parts: outline and internal filling.

4 Process classification and grade

4.1 Process classification

According to the feeding method, the extrusion molding process is divided into piston-type filament extrusion process and screw-type granule extrusion process. According to the number of extrusion nozzles, it is divided into single

NOTE: The colors in 5.2.2.1 and 5.2.2.2 can be measured with a colorimeter and compared with the color card.

5.2.3 Environmental characteristics

Environmental characteristics mainly include thermal volatility and water absorption.

5.3 Packaging, marks, transportation and storage

5.3.1 There shall be a clear mark on the material packaging bag. The content of the mark may include: the name of the material, the shape and size, the name of the manufacturer, the batch number and the date of manufacture, and the net weight. In order to facilitate traceability, the packaging shall have a unique mark.

5.3.2 Adequate protection of materials shall be provided during routine handling and transportation. See GB/T 9174 for implementation.

5.3.3 Materials shall be stored in a dry, ventilated, clean and well-maintained warehouse with fire-fighting facilities. Necessary measures such as sealed packaging shall be taken to prevent the material from being wet.

5.4 Recycle

Refer to HJ/T 364 for waste plastic recycling, transportation and storage conditions.

6 Equipment

6.1 General requirements

6.1.1 The equipment shall be equipped with user instruction documents, including items, cycles and standards for regular inspections.

6.1.2 The instruments and meters used for the process control of the plastic material extrusion molding process shall be regularly measured and calibrated in accordance with the relevant regulations of the country or the enterprise.

6.2 Process parameters

It is recommended to use the process parameters that come with the equipment, or use the process parameters obtained through experiments.

6.3 Personnel

Operators shall receive training, including but not limited to the operation,

According to the tool path specified in Table 3, prepare at least 3 specimens for each path used to evaluate mechanical properties such as bending strength and modulus, shear strength, modulus and impact strength. Refer to GB/T 9341 for the determination of bending performance. Use the short beam method to measure the interlaminar shear strength, see JC/T 773. Refer to GB/T 1043.2 for the determination of the impact performance of simply supported beams.

7.3 Precision inspection

The precision inspection shall be carried out in accordance with the provisions of GB/T 39329.

8 Molding process

8.1 Molding preparation

Before each molding, the extrusion nozzle and molding platform shall be cleaned and maintained, and the materials shall be loaded. Debug the device to the state to be printed.

8.2 Molding parameters

All or part of the following parameters and other parameters required by the customer shall be recorded according to the characteristics of the equipment and customer needs:

- Molding temperature (melting cavity temperature or extrusion screw, piston temperature);
- Fill rate;
- Feed rate;
- Extrusion nozzle outlet diameter;
- Layer thickness;
- Molding room temperature;
- Molding platform temperature;
- Moving speed of extrusion nozzle or molding platform.

8.3 Post processing

8.3.1 After molding, the support material shall be removed from the part.

- Detailed material batch information;
- Necessary mechanical property data (such as tensile data);
- Data such as special size information and chemical properties required by customers.

10 Inspection

10.1 Requirements

10.1.1 The necessary quality inspections shall be carried out before the parts are delivered. The supplier and the purchaser negotiate to determine the sampling method, test items and technical indicators as the delivery and acceptance conditions.

10.1.2 The main characteristics and test methods of the parts shall meet but not limited to the provisions of GB/T 35022.

10.2 Re-inspection

The purchaser can conduct re-inspection according to the requirements of 10.1 in accordance with the agreement between the two parties. When the re-inspection result is unconforming, the supplier and the purchaser shall negotiate and resolve.

11 Technical data delivery

The delivered parts shall contain but not limited to the following information:

- Supplier information (name, address and contact information);
- Part name and material composition;
- Certificate of conformity;
- Implementation standard number;
- Number of parts;
- Date of manufacture;
- Post processing record;
- Product packaging, transportation, storage and other requirements.

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