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National standard of the People's Republic of China

GB/T 38714—2020

**High thermal conductivity magnesium alloy profiles**

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**高导热镁合金型材**

**（English Translation）**

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 Standardization Administration of the People’s Republic of China

Foreword

SAC/TC 243 is in charge of the English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

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

This standard is proposed by the China Nonferrous Metals Industry Association.

This standard was prepared by the National Technical Committee for Standardization of Nonferrous Metals (SAC/TC 243).

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**High thermal conductivity magnesium alloy profiles**

1. Scope

This standard specifies the technical requirements, test methods, inspection rules and markings, packaging, transportation, storage, quality certificates and order forms (or contracts) of high thermal conductivity magnesium alloy profiles.

This standard is applicable to the magnesium alloy extruded profiles (hereinafter referred as profiles) with the thermal conductivity no less than 110 W·(m·K)-1.

1. 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 4297 *Inspection method for macrostructure of wrought magnesium alloy products*

GB/T 5153 *Designation and composition of wrought magnesium and magnesium alloys*

GB/T 5156-2013 *Magnesium alloy extruded profiles*

GB/T 8170 *Rules of rounding off for numerical values & expression and judgement of limiting values*

GB/T 13748 *(In whole) Chemical analysis methods of magnesium and magnesium alloys*

GB/T 16475 *Temper designation system for wrought aluminium and aluminium alloy*

GB/T 16865 *Test pieces and method for tensile test for wrought aluminium and magnesium alloys products*

GB/T 17432 *Methods for sampling for analyzing the chemical composition of wrought aluminium and aluminium alloy*

GB/T 20967 *Non-destructive testing―Visual testing*

GB/T 22588 *Determination of thermal diffusivity or thermal conductivity by the flash method*

GB/T 32792 *Packing, marking, transporting and storing of magnesium alloy wrought products*

1. Technical requirement
	1. Classification of profiles
		1. Alloy designation and temper

The alloy designation and temper of the profile shall comply with the requirements in Table 1. When the demander has other alloy designation or temper requirements, it shall be negotiated between the supplier and demander and specified in the order form (or contract).

Table 1 Alloy designation and temper

|  |  |
| --- | --- |
| Alloy designation | Temper |
| M1C、M2S、ME20M、ZE20M | H112 |
| ZK60A、ZM51M | T5 |

* + 1. Marking of profile

Profile markings are indicated in the order of profile designation, standard number, alloy designation, temper and dimension. Examples of markings are as follows:

Example 1:

Alloy designation of ME20M, temper of H112, model of XC141-7, indeterminate profile, marked as:

GB / T 38714- ME20M H112- XC141-7

Example 2:

Alloy designation of ZK60A , temper of T5, model of XC6283, profile with 3800 mm in lengths, marked as:

GB / T 38714- ZK60A T5- XC6283 × 3800

* 1. Chemical composition

The chemical composition of the profile shall be in accordance with the requirements of GB/T 5153.

* 1. Allowable dimension variation

The dimensional variation of the profile shall be in accordance with the ordinary level in GB / T 5156-2013.

* 1. Mechanical property at room temperature

The longitudinal tensile properties of the profiles at room temperature shall meet the requirements of Table 2.

Table 2 Tensile property at room temperature

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alloy designation | Temper | Tensile strength RmMPa | Yield strength Rp0.2MPa | Elongation A % |
| Not less than |
| M1C | H112 | 215 | 140 | 13.0 |
| M2S | H112 | 210 | 155 | 10.0 |
| ZE20M | H112 | 210 | 120 | 19.0 |
| ME20M | H112 | 185 | 135 | 8.0 |
| ZK60A | T5 | 310 | 235 | 12.0 |
| ZM51M | T5 | 310 | 260 | 10.0 |

* 1. Thermal conductivity

The thermal conductivity of the profile shall meet the requirements of Table 3.

Table 3 Thermal conductivity

|  |  |  |
| --- | --- | --- |
| Alloy designation | Temper | Thermal conductivity W·(m·K)-1 |
| No less than |
| M1C | H112 | 130 |
| M2S | H112 | 125 |
| ZE20M | H112 | 125 |
| ME20M | H112 | 120 |
| ZK60A | T5 | 115 |
| ZM51M | T5 | 120 |

* 1. Macrostructure

3.6.1 Defects such as cracks, pores, and tail shrinkage that damage the continuity of metal are not allowed on the macrostructure samples of profiles.

3.6.2 Lamination with a depth of no more than half of the negative deviation of the diameter is allowed on the surface of the profile.

* 1. Appearance

3.7.1 The surface of the profile shall be clean, and defects such as cracks, corrosion spots, and various intrusions that affect the usage are not allowed.

3.7.2 Defects with the depth not exceeding a negative deviation, such as extrusion trail, dent, bruise, bubble, abrade, scratch, convex and concave, are allowed on the surface of the profile.

1. Test method

4.1 Chemical composition

The chemical analysis and arbitration of the profile shall be carried out in accordance with GB / T 13748.

4.2 Dimensional deviation

The dimensional deviation of the profile is measured with a measuring instrument of corresponding accuracy.

4.3 Mechanical property

The mechanical property test of the profile is carried out in accordance with GB / T 16865.

4.4 Thermal conductivity

The thermal conductivity of the profile is measured in accordance with the thermal conductivity method specified in GB / T 22588.

4.5 Macrostructure

The test methods for macrostructure of the bars shall be in accordance with GB / T 4297.

4.6 Appearance

The test methods for appearance of the bars shall be in accordance with GB / T 20967.

1. Inspection rules

5.1 Inspection and acceptance

5.1.1 The profiles shall be inspected by the supplier to ensure that the quality of the profile conforms to the requirements of this standard and the order form (or contract), and fill in the quality certificate.

5.1.2 The demander shall inspect the received profiles in accordance with the provisions of this standard. If the inspection results are inconsistent with the requirements of this standard and the order form (or contract), they shall be submitted to the supplier in written form, and shall be determined through consultation between the supplier and the demander. Objections that belong to the surface quality or external dimensions shall be filed within one month from the date of receiving the profile. Objections that are of other nature shall be filed within three months from the date of receiving the profile. If arbitration is needed, it shall be determined through consultation between the supplier and the demander.

5.2 Batch

Profile shall be submitted for acceptance in batches, and each batch shall consist of sections of the same alloy designation, same temper, same dimensions, same melt and the same heat treatment furnace. The batch weight is not limited.

5.3 Inspection item

5.3.1 The inspection items and sampling of profiles shall meet the requirements of Table 4. The inspection items are divided into delivery inspection items and type inspection items.

5.3.2 Each batch of profiles shall be inspected for chemical composition, dimensional deviation, mechanical properties, macrostructure and appearance before delivery.

5.3.3 Type inspection shall be carried out when any of the following situations occur:

a) When new profile is developed or plant transfer of primary profile;

b) When the raw materials or production processes of the profile have changed greatly which may affect the performance of the profile;

c) When the structure of the profile is greatly changed;

d) When production of profiles resumes after stopped;

e) When the inspection results are significantly different from the last inspection;

f) When no type inspection has been performed for two consecutive years;

g) When requested by the demander;

h) When a national quality supervision agency requests a type inspection.

Table 4 Inspection items and sampling

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Inspection items | Sampling rules | Required chapter number | Chapter number of test method | Delivery inspection | Type inspection |
| Chemical composition | Be in accordance with GB / T 17432, and take one sample form each batch | 3.3 | 4.1 | √ | √ |
| Dimensional deviation | Inspected one by one | 3.4 | 4.2 | √ | √ |
| Room temperature mechanical property | Sampling in accordance with GB / T 16865. Take 10% of profiles in each batch, no less than two samples, and cut one sample in the tail end of the selected extruded profiles. | 3.5 | 4.3 | √ | √ |
| Thermal conductivity | Sampling in accordance with GB / T 16865. Take 10% of profiles in each batch, no less than two samples, and cut one sample in the tail end with small thickness of the selected extruded profiles.  | 3.6 | 4.4 | - | √ |
| Macrostructure | Take 10% of profiles in each batch, no less than two samples, and cut one sample in the tail end of the selected extruded profiles. | 3.7 | 4.5 | √ | √ |
| Appearance quality | Inspected one by one | 3.8 | 4.6 | √ | √ |

5.4 Judgment of inspection result

5.4.1 When the chemical composition is unqualified, the batch is judged unqualified.

5.4.2 When the dimensional deviation is unqualified, the profile is judged unqualified.

5.4.3 When mechanical property is unqualified, double number of samples from the batch of profiles (including the original unqualified profiles) shall be taken for repeated tests. If one of the samples in the repeated test is still unqualified, the batch of profiles is judged unqualified.

5.4.4 When thermal conductivity is unqualified, the batch is judged unqualified.

5.4.5 When the macrostructure of any sample is unqualified, it shall be judged as follows:

a) When the samples have unqualified cracks, oxide films, segregation of metal compounds and manganese compounds, the batch shall be rejected.

b) When the samples have unqualified tail shrinking and lamination, it is allowed to repeat the test after cutting off a certain length of the unqualified profile until qualified. Other profiles shall be either inspected one by one and the qualified bar can be delivered, or cut the profiles with maximum unqualified length from the retest and then delivery. In case of other defects, the batch of profiles shall be negotiated by both parties.

5.4.6 When the appearance is unqualified, the profile is judged unqualified.

1. Marking, packaging, transportation and storage, quality certificate

6.1 Marking

6.1.1 Profile marking

The following marking shall be stamped in the front of the qualified profile (or a label with the following marking):

a) Stamp of the supplier's technical supervision department;

b) Alloy designation;

c) Temper;

d) Dimensions;

e) Profile batch number.

6.1.2 Packaging marking

Marking of the packaging box of the profile shall conform to GB / T 32792.

6.2 Packaging, transportation and storage

6.2.1 Profiles shall be packed with protection. If there are special requirements, it shall be negotiated between the supplier and the demander and specified in the order form (or contract).

6.2.2 Other requirements for the packaging, transportation and storage of profiles shall conform to GB / T 32792.

6.3 Quality certificate

Each batch of profiles shall be accompanied by a profile quality certificate, which states:

a) Supplier name, address, telephone, fax;

b) Profile designation;

c) Alloy designation;

d) Temper;

e) Dimensions and accuracy levels;

f) Batch number;

g) Net weight and number of packages;

h) All inspection results;

i) Stamp of the supplier's technical supervision department;

j) This standard number;

k) Packaging date (or manufacturing date).

1. Order form (or contract)

The order form (or contract) for the profiles listed in this standard shall include the following:

a) Profile designation;

b) Alloy designation;

c) Temper;

d) Dimensions and allowable dimension deviation;

e) Net weight or number of packages;

f) Special requirements of demander:

——Special dimensional deviation requirements;

——Special requirements for tensile properties;

——Special package requirements;

——Other special requirements;

g) This standard number;

h) Others.