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ISO RECOMMENDATION

R 1874

PLASTICS

SPECIFICATION FOR POLYAMIDE HOMOPOLYMERS

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BRIEF HISTORY

The ISO Recommendation R 1874, *Plastics – Specification for polyamide homopolymers,* was drawn up by Technical Committee ISO/TC 61, *Plastics,* the Secretariat of which is held by the American National Standards Institute (ANSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1874, which was circulated to all the ISO Member Bodies for enquiry in September 1969.

The Draft was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Israel	Sweden
Austria	Japan	Switzerland
Belgium	Netherlands	Turkey
Canada	New Zealand	U.A.R.
Chile	Poland	United Kingdom
Czechoslovakia	Portugal	U.S.A.
Germany	Romania	U.S.S.R.
Greece	South Africa, Rep. of	
Hungary	Spain	

The following Member Body opposed the approval of the Draft :

France

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

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PLASTICS

SPECIFICATION FOR POLYAMIDE HOMOPOLYMERS

1. SCOPE

This ISO Recommendation specifies basic grades of polyamides of the 6, 66, 610, 11 and 12 types. The specification covers only homopolymers in the form of granulate.

Many applications will require polymers modified by inclusion of antioxidants, pigments, fillers or other additives of such a type and in such a proportion as may be agreed between manufacturer and purchaser. For such materials, and for certain specialized applications, additional test requirements may also be agreed between manufacturer and purchaser.

2. DEFINITIONS

For the purpose of this ISO Recommendation the following definitions apply :

Polyamide 6 (PA 6). A polymer of ϵ-caprolactam.

Polyamide 66 (PA 66). A polymer of hexamethylene diamine and adipic acid.

Polyamide 610 (PA 610). A polymer of hexamethylene diamine and sebacic acid.

Polyamide 11 (PA 11). A polymer of 1,11-aminoundecanoic acid.

Polyamide 12 (PA 12). A polymer of 1,12-dodecanolactam.

EXPLANATION

The polymers of the lactams are designated by one number, corresponding to the number of carbon atoms in the monomer.

The polymers of diamines and diacids are designated by two numbers, the first indicating the number of carbon atoms in the diamine and the second the number of carbon atoms in the diacid. These two numbers are written concurrently without interval or hyphen.

3. DESIGNATIONS

The polyamide grades covered by this ISO Recommendation are designated by one or two numbers, indicating the type of polyamide (6 for PA 6, 66 for PA 66, 610 for PA 610, 11 for PA 11, and 12 for PA 12), followed by three numbers, indicating respectively the range of the viscosity, the content of extractables and the use of additives. As this ISO Recommendation only covers basic polymers, the last number will be O.

4. GENERAL REQUIREMENTS

4.1 The granulate should be of uniform shape, the dimensions of the granules being within limits agreed between manufacturer and purchaser. Other details, such as colour, level of contamination, uniformity, presence of specks and disparate coloured granules, should be agreed between manufacturer and purchaser.

4.2 The water content of the granulate as received by the purchaser and determined according to ISO Recommendation R 960, *Plastics – Determination of the water content in polyamides,* should be less than 0.25 %, unless otherwise agreed between manufacturer and purchaser.

5. DETAIL REQUIREMENTS

The various grades should conform to the requirements listed in Tables 1 and 2. The properties should be determined on granulate, sampled from freshly opened tins or other packages.

5.1 Sampling

Sampling should be carried out as agreed between manufacturer and purchaser.

5.2 Number of determinations

Duplicate determinations, using two separate samples, are considered sufficient for testing each batch of granulate. The average result should conform to the requirements of this specification. If necessary, the tests are repeated on two additional samples from the same batch.

5.3 Melting point

The melting point should be determined according to ISO Recommendation R 1218, *Plastics – Determination of the "melting point" of polyamides,* or by any other method giving equivalent results.

5.4 Density

The density should be determined according to ISO Recommendation R 1183, *Methods for determining the density and relative density (specific gravity) of plastics excluding cellular plastics.* Excess water absorption should be avoided as water may influence the density.

5.5 Viscosity number (see ISO Recommendation R 307, *Determination of the viscosity number of polyamides resins in dilute solution*)

Formic acid is used for PA 6, PA 66 and PA 610. Metacresol is used for PA 11 and PA 12. If the range of the viscosity of a certain commercial grade covers more than one of the intervals listed in Tables 1 and 2, the relevant commercial grade should be indicated as conforming to more than one of the grades specified in this ISO Recommendation. For example, a PA 6 grade with a low content of extractables and a viscosity number of 100 to 110 is considered as "6 – 110/210 grade".

In the specification and testing of polyamides it should be recognized that the reproducibility of the method (see ISO/R 307) has been shown to be no better than ± 3 %, and considerably poorer at higher levels.

Therefore, the range of viscosity number of a given grade, either indicated by the producer or obtained experimentally according to clause 5.2, may not cover more than two consecutive grade steps as specified in Tables 1 and 2.

With agreement between manufacturer and purchaser on values of viscosity ratio to be specified, ISO Recommendation R 600, *Plastics – Determination of the viscosity ratio of polyamides in concentrated solution,* may be used in place of ISO/R 307.

5.6 Content of extractables

The content of extractables should be determined according to ISO Recommendation R 599, *Plastics – Determination of the percentage of extractable materials in polyamides.*

5.7 Solubility in formic acid

A few granules should be shaken in a test tube containing a 90 % (m/m) formic acid solution at room temperature (15 to 25 °C). If the granules are dissolved completely within 15 minutes, the material is regarded as "soluble". Otherwise, the material is regarded as "not soluble".

5.8 Ash content

The maximum ash content, determined according to ISO Recommendation R . . .*, should be 0.01 %, unless otherwise agreed.

* At present at the stage of draft proposal.

TABLE 1 – Detail requirements for PA 6 and PA 66

PA type	Grade designation	Melting point (ISO/R 1218) °C	Density (ISO/R 1183) g/cm³	Viscosity number (ISO/R 307)	Content of extractables (ISO/R 599) %	Solubility in formic acid at room temperature (clause 5.7)
6	6 – 110 6 – 210 6 – 310 6 – 410 6 – 510 6 – 610 6 – 710 6 – 810 6 – 910	210 to 230	1.12 to 1.14	95 to 105 106 to 115 116 to 125 126 to 150 151 to 180 181 to 220 221 to 300 301 to 400 > 400	2 (maximum)	soluble
6	6 – 190 6 – 290 6 – 390 6 – 490 6 – 590 6 – 690 6 – 790 6 – 890 6 – 990	210 to 230	1.12 to 1.14	95 to 105 106 to 115 116 to 125 126 to 150 151 to 180 181 to 220 221 to 300 301 to 400 > 400	8 to 12	soluble
66	66 – 100 66 – 200 66 – 300 66 – 400 66 – 500 66 – 600 66 – 700 66 – 800 66 – 900	250 to 270	1.13 to 1.15	95 to 105 106 to 115 116 to 125 126 to 150 151 to 175 176 to 200 201 to 250 251 to 340 > 340	not specified	soluble

TABLE 2 – Detail requirements for PA 610, PA 11 and PA 12

PA type	Grade designation	Melting point (ISO/R 1218) °C	Density (ISO/R 1183) g/cm³	Viscosity number (ISO/R 307)	Content of extractables (ISO/R 599) %	Solubility in formic acid at room temperature (clause 5.7)
610	610 – 100 610 – 200 610 – 300 610 – 400 610 – 500 610 – 600	205 to 225	1.07 to 1.09	80 to 110 111 to 140 141 to 160 161 to 180 181 to 240 > 240	not specified	not soluble
11	11 – 100 11 – 200 11 – 300 11 – 400 11 – 500 11 – 600	180 to 195	1.03 to 1.05	100 to 140 141 to 180 181 to 220 221 to 260 261 to 300 > 300	not specified	not soluble
12	to be specified	170 to 190	1.01 to 1.04	to be specified	not specified	not soluble

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