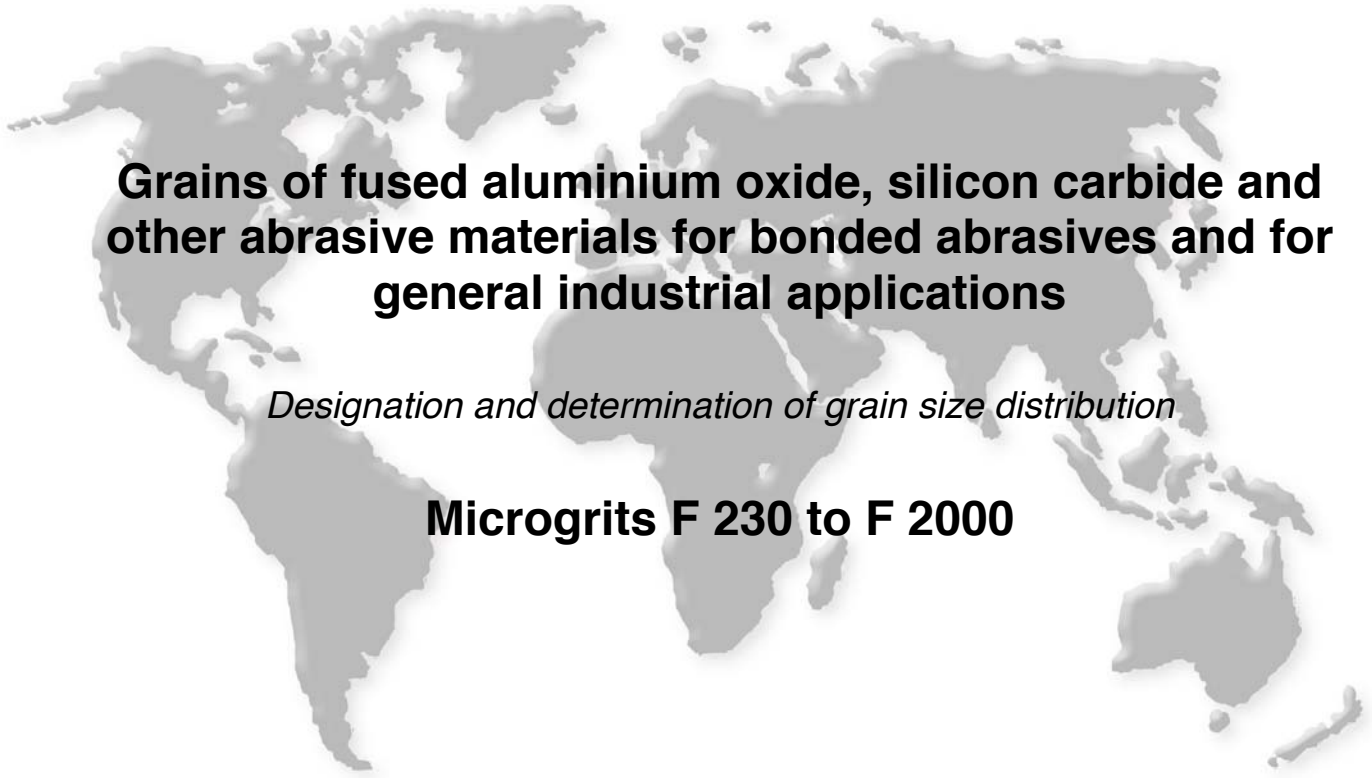
FÉDÉRATION EUROPÉENNE
DES FABRICANTS
DE PRODUITS ABRASIFS



Grains of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasives and for general industrial applications

Designation and determination of grain size distribution

Microgrits F 230 to F 2000

Standard 42-2:2006(en)

DOCU-2024-020

Introduction

This European standard has been drawn up in close collaboration between **FEPA (Fédération Européenne des Fabricants de Produits Abrasifs)** Committees I (Bonded Abrasives) and III (Abrasive Grains). It supersedes all previous FEPA grain size standards of the F-series.

The thorough revision and restructuring of previous FEPA standards for abrasives grain sizes of the F-series has been necessary mainly because of technical advances in the field of particle size measurements.

The Members of FEPA have approved this standard in the subsequent form.

Contents

Grains of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasives and for general industrial applications

1 Field of application

This standard specifies the designation, the size distributions, marking, the test method and the evaluation of the test results of micrograins of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasive products and for general industrial applications.

2 Grain size designation

The designation of grains of fused aluminium oxide, silicon carbide and other abrasive materials consists of:

- type of the abrasive
- designation of the grain size
- valid FEPA standard

Examples:

Designation:..... Silicon carbide – F 400 – FEPA 42-2:2006(en)
Short designation:..... SiC – F 400
Name of the Abrasive: ..... Silicon carbide – F 400 FEPA
Short term of the grain:..... F 400

3 Microgrits

Microgrits are defined as grits with grain size distribution that are defined by means of sedimentation.

3.1 Grain size distribution

The grain size distribution of microgrits F 230 to F 2000 is determined by the following criteria:

- the grain size (theoretical grain diameter) shall not exceed the maximum permissible d_{s3}-value at the 3 % point of the grain size distribution curve,
- the median grain size (theoretical grain diameter) shall be within the specified tolerances of the d_{s50}-value at the 50 % point of the grain size distribution curve,
- the grain size (theoretical grain diameter) shall at least attain the d_{s94}- or d_{s80}-value at the 94 %- or 80 %-point of the grain size distribution curve.

The three criteria shall be met at the same time. The values are specified in Table 1.

Table 1: Grain size distribution of microgrits F 230 to F 2000

Grit designation	Median grain size in µm		
	d_{s3}-value max.	d_{s50}-value	d_{s94}-value* min.
F 230	82	53.0 ± 3.0	34
F 240	70	44.5 ± 2.0	28
F 280	59	36.5 ± 1.5	22
F 320	49	29.2 ± 1.5	16.5
F 360	40	22.8 ± 1.5	12
F 400	32	17.3 ± 1.0	8
F 500	25	12.8 ± 1.0	5
F 600	19	9.3 ± 1.0	3
F 800	14	6.5 ± 1.0	2
F 1000	10	4.5 ± 0.8	1
F 1200	7	3.0 ± 0.5	1 (at 80 %)
F 1500	5	2.0 ± 0.4	0.8 (at 80 %)
F 2000	3.5	1.2 ± 0.3	0.5 (at 80 %)
* For F 1200, F 1500 and F 2000 d_{s80}-value is determined			

3.2 Grading of microgrits

The F-series is a graduated series of thirteen microgrits starting at a median particle size of 53 microns and ending at 1.2 microns. This series follows on from the finest grain in the F-series macrogrits F 220[1)] (63 microns) and uses the same ratio as that series i.e. $\sqrt[4]{2}$.

The calculation of the individual grain size values has been made as follows:

- the ratio of the median grain sizes F 230 and F 240 is
  $= \sqrt[4]{2 \cdot f^{0}}$
  i.e. it corresponds approximately to the progressive ratio of the test sieves for macrogrits.
- the ratio of the median grain sizes F 240 and F 280 is
  $= \sqrt[4]{2 \cdot f^{1}}$
- the ratio of the next grain sizes is
  $= \sqrt[4]{2 \cdot f^{n}}$
  where n = 2, 3, ... 13
  and where the following equation applies to the factor "f"
  $$f = \sqrt[66]{\frac{53}{1.2 \cdot \left(\sqrt[4]{2}\right)^{12}}} = 1.0261$$

These follow a series of ratios starting at 1.189 and ending at 1.581.

[1)] FEPA-Standard 42-1:2006(en)

4 Marking

When packing grits of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasive products and for general industrial applications, it is necessary that at least the grit designation is marked on each of the smallest unit of packing, e.g. F 400.

5 Test methods

5.1 Mastergrits

The test method is based on Micro-F-Mastergrits[1)].

A certificate of the Staatlichen Materialprüfungsanstalt Darmstadt (MPA), stating the value at the 50 % point determined by means of a co-operative test carried out by FEPA, shall accompany each Micro-F-Mastergrits. The values measured shall be corrected on the basis of the Mastergrits values.

5.2 Testing by sedimentation

The testing method for microgrits F 230 to F 2000 is done by sedimentation.

The limits are given in Table 1.

5.3 Testing by other measuring principles

Determination of particle size distribution by means of other principles than the sedimentation (electrical resistance method, laser diffraction, picture analysis) can give deviating results from Table 1.

5.3.1 Testing by electrical resistance method

This method gives in most cases adequate results, but due to differences in measuring principles it may deviate from sedimentation.

5.3.2 Other measuring principles

When using other measuring principles, e.g. laser diffraction instruments, one shall be aware that the particle size distribution is strongly influenced by grain shape.

5.4 Designation of testing method

The measuring technique used when testing Microgrits F 230 to F 2000 shall be given together with the results, e.g.:

Test – Micro F – Sedigraph 5100
or
Test – Micro F – US-Sedimentometer
or
Test – Micro F – Coulter Multisizer III

[1)] Micro-F-Mastergrits of fused aluminium oxide and silicon carbide can be obtained from:
Staatliche Materialprüfungsanstalt Darmstadt, Grafenstraße 2, 64283 Darmstadt, Germany or
FEPA, 20 Avenue Reille, 75014 Paris, France

6 Preparation of the sample

When the test method is on dry material the sample shall be heated at a temperature of (110 ± 5) °C for at least 10 minutes, and cooled to room temperature.

It is recommended to eliminate agglomerates by treatments (e.g. ultrasonic) of the dispersed sample.

For X-ray and photo sedimentometer the following (Table 2) sedimentation medium and dispersing agent shall be used.

Table 2: Sedimentation medium and dispersing agent for testing of grains of aluminium oxide and silicon carbide

Grit designation	Medium for sedimentation at 20 °C	Dispersing agent Tetrasodium diphosphate in g/l	
		Aluminium oxide	Silicon carbide
F 230 F 240	1.2 Ethandiol 95 %, viscosity 15.2 mPa · s, Density 1.107 g/cm³	0.2	0.2
F 280 F 320 F 360 F 400	1.2 Ethandiol 74 %, viscosity 7.7 mPa · s, Density 1.091 g/cm³	0.2	0.2
F 500	Deionised water conductivity ≤ 5 µS	0.45	0.2
F 600 F 800			0.1
F 1000 F 1200 F 1500 F 2000	Deionised water conductivity ≤ 5 µS	0.45	No additive

7 Test procedure

The test shall carried out in accordance with the instructions for the measuring instrument used.

8 Determination of grain size distribution

The principle upon which this Standard is based is by comparison of the d_{s50} (50 % by volume/weight) point given by the Micro-F-Mastergrits, with that determined by the testing laboratory on its own instruments.

The difference between these two values will also be added algebraically to the 3 %-, 50 %- and 94 %- or 80 %- values of the sample.

The following method applies:

- Determine the d_{s50}-value of the Micro-F-Mastergrits and calculate the difference between this value and the corresponding value shown on the MPA Darmstadt certificate.
- Measure the d_{s3}-, d_{s50}- and d_{s94}- or d_{s80}- values of the sample and add algebraically the difference as determined above.
- Compared the corrected results with the values in Table 1.

Example: SiC F 240, for d_{s50}-value:

Mastergrit (MG):	
MG- d_{s50}-value according to MPA certificate	44.9 µm
MG- d_{s50}-value measured	42.3 µm
Difference	+2.6 µm
Sample:	
d_{s50}-value measured	42.8 µm
To be added	+2.6 µm
Corrected d_{s50}-value of the sample	45.4 µm

From Table 1 this value is within the tolerances of the d_{s50}-value for grit F 240.

9 Evaluation of the test results

A sample complies with the Standard if the corrected values according to Section 8 for d_{s3}-, d_{s50}- and d_{s94}- or d_{s80}-values are within the permissible limits given in Table 1.

10 Permissible deviations

When retesting the measured results allowance shall be made for the variations due to the measuring technique (measuring techniques include: sampling, sample preparation, different operators and instruments). These permissible deviations given in Table 3, have been determined on the basis of the standard deviations resulting from a co-operative test carried out by FEPA. The tolerances given in Table 1, are to be increased by these values.

Table 3: Permissible deviations as a result of variations in the measuring technique

Grit designation	Permissible deviations for the values in µm		
	d_{s3}-value	d_{s50}-value	d_{s94}-value*
F 230 F 240	+3.5	±2.5	-1.5
F 280 F 320 F 360 F 400	+2.5	±1.5	-0.8
F 500 F 600 F 800	+2.0	±1.0	-0.5
F 1000	+1.5	±0.5	-0.4
F 1200	+1.5	±0.5	-0.4 (at 80 %)
F 1500	+1.0	±0.4	-0.3 (at 80 %)
F 2000	+1.0	±0.3	-0.3 (at 80 %)
* For F 1200, F 1500 and F 2000 d_{s80}-value is determined			

Example: Grit F 280 on d_{s3}-value.

Retesting of the grit F 280 will include the variations shown in Table 3. In the case of d_{s3}-value it means that the 59 µm limit increases to 61.5 µm according to Table 3 (+ 2.5 µm).

Appendix: Standards and Literature

FEPA standards[1)]

FEPA-Standard 42-1:2006(en)

Grains of fused aluminium oxide, silicon carbide and other abrasive materials for bonded abrasives and for general industrial applications
Macrogrits F 4 to F 220

FEPA-Standard 43-1:2006(en)

Grains of fused aluminium oxide, silicon carbide and other abrasive materials for coated abrasives
Macrogrits P 12 to P 220

FEPA-Standard 43-2:2006(en)

Grains of fused aluminium oxide, silicon carbide and other abrasive materials for coated abrasives
Microgrits P 240 to P 2500

FEPA-Standard 44-1:2006(en)

Grains of fused aluminium oxide, silicon carbide and other abrasive materials
Determination of bulk density - Macrogrits F- and P-series

FEPA-Standard 44-2:2006(en)

Grains of fused aluminium oxide, silicon carbide and other abrasive materials
Determination of bulk density - Microgrits F- and P-series

FEPA-Standard 44-3:2006(en)

Grains of fused aluminium oxide, silicon carbide and other abrasive materials
Sampling and splitting

FEPA-Standard 45-GB-1986 R 1993

Chemical analysis of silicon carbide

FEPA-Standard 46-GB-1986 R 1993

Chemical analysis of fused aluminium oxide

[1)] Available from:
Staatliche Materialprüfungsanstalt Darmstadt, Grafenstraße 2, 64283 Darmstadt, Germany or
FEPA, 20 Avenue Reille, 75014 Paris, France

ISO standards

ISO 3310-1	Test sieves - Technical requirements and testing – Test sieves of metal wire cloth
ISO 6344	Coated abrasives - Grain size analysis
-1	Definitions, designation and principle
-2	Testing of macrogrits P 12 to P 220
-3	Testing of microgrits P 240 to P 2500
ISO 8486	Bonded abrasives - Grain size analysis - Designation and determination of grain size distribution
-1	Macrogrits F 4 to F 220
-2	Microgrits F 230 to F 2000
ISO 9136	Determination of bulk density
-1	Macrogrits F 4 to F 220
-2	Microgrits F 230 to F 2000
ISO 9137	Abrasive grains - Determination of capillarity
ISO 9138	Abrasive grains - Sampling and splitting
ISO 9284	Abrasive grains - Test-sieving machines
ISO 9285	Abrasive grains and crudes - Chemical analysis of fused aluminium oxide
ISO 9286	Abrasive grains and crudes - Chemical analysis of silicon carbide

Literature

Schönbrunn, G.; Schütz, W.: „Die Siebanalyse der Schleifmittelkörnungen, ihre Reproduzierbarkeit und ihre Fehlerquellen“
Fachber. f. Oberflächentechnik 7, 1969; Heft 9/10, S. 169-174.