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International Standard



8003

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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**Carbonaceous materials used in the production  
of aluminium — Pitch for electrodes — Measurement of  
dynamic viscosity**

*Produits carbonés utilisés pour la production de l'aluminium — Brai pour électrodes — Détermination de la viscosité dynamique*

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## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8003 was prepared by Technical Committee ISO/TC 47, *Chemistry*.

# Carbonaceous materials used in the production of aluminium — Pitch for electrodes — Measurement of dynamic viscosity

## 1 Scope and field of application

This International Standard specifies two methods of determining the dynamic viscosity of a sample of pitch, which is used as a binder for the manufacture of electrodes required in the electrolytic production of aluminium. The two methods have the same validity for pitches of Newtonian nature and, for these pitches, they are presented as alternative methods.

### — Method A (Ball displacement method)

The method is applicable to pitches of newtonian nature, i.e. containing no additional material. The measurement of the viscosity shall be carried out at a temperature greater than the softening temperature and not greater than 180 °C.

The measuring range of the method is  $10^2$  to  $10^4$  mPa·s.

### — Method B (Rotation of a cylindrical body method)

The method is applicable to the pitches indicated for method A and to pitches for which a non-newtonian nature may be assumed, either because they have been treated at high temperature (presence of mesophase) or due to the necessity of being examined at high temperature (greater than 180 °C). This method allows the non-newtonian nature of a pitch to be characterized.

The method is applicable to pitches having a maximum viscosity of  $3 \times 10^6$  mPa·s.

## 2 References

ISO 6257, *Carbonaceous materials used in the production of aluminium — Sampling.*

ISO 6388, *Surface active agents — Determination of flow properties using a rotational viscometer.*

## 3 Method A

### 3.1 Principle

Determination of the viscosity of a pitch at a given temperature determined using a sample of pitch having similar characteristics by measurement of the time a ball, drawn by a defined

force, requires to traverse a fixed distance within a measuring tube filled with the sample of molten pitch.

The test results are given as dynamic viscosity in absolute units of "millipascal seconds" (mPa·s)\*.

### 3.2 Apparatus and materials

#### 3.2.1 Viscometer (see the figure)

The viscometer is designed similar to a two-arm lever balance consisting of the following items:

- a support (15) with a knife-edge bearing at the top;
- a ball (2), diameter  $15,00 \pm 0,02$  mm, of stainless steel (C  $\leq$  0,07 %, Si  $\leq$  1,00 %, Mn  $\leq$  2,00 %, P  $\leq$  0,045 %, S  $\leq$  0,03 %,  $17,00 \leq$  Cr  $\leq$  20,00 %,  $8,50 \leq$  Ni  $\leq$  10,00 %, coefficient of linear expansion  $17 \times 10^{-6} \text{ K}^{-1}$ );
- a rod (13), diameter 2 mm, of stainless steel [same composition as for the ball (2)];
- a measuring tube (1), internal diameter  $16,15 \pm 0,05$  mm, external diameter 20 mm, length 200 mm, of stainless steel [same composition as for the ball (2)];
- a jacket tube (14) for thermostatic regulation, internal diameter 90 mm of stainless steel [same composition as for the ball (2)];
- an entrance and exit nozzle (11);
- a screw cap with stopper (12);
- two precision thermometers (8):
  - range: 99 to 151 °C, maximum error: 0,1 °C,
  - range: 149 to 201 °C, maximum error: 0,1 °C,
  - length of the immersed part:  $140 \pm 5$  mm;
- a balance lever (4) with knife-edge supports;
- a weight pan (3);
- a pointer (5), the length of which must be at least twice as long as the lever arm and which is chosen in such a way that the distance covered by the pointer is twice that covered by the ball;

\* 1 mPa·s = 1 cP (centipoise)