

ABB MEASUREMENT & ANALYTICS

# The complete solution for inclusion measurement

## PoDFA



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## Measurement made easy

**PoDFA is a proprietary technology for melt cleanliness evaluation that provides information on the composition and concentration of inclusions in molten aluminum.**

**PoDFA has already demonstrated its great potential for process characterization and optimization, as well as for product improvement.**

# PoDFA

## The complete solution for inclusion measurement

— 01 Melt cleanliness evaluation process

— 02 PoDFA technology

— 03 PoDFA-f system

Today's global marketplace has compelled aluminum producers and foundries to produce the highest quality aluminum and shape castings. The most effective means of attaining superior levels of quality is expertise in process coupled with systematic measurement for controlling the melt quality at all stages of manufacturing.



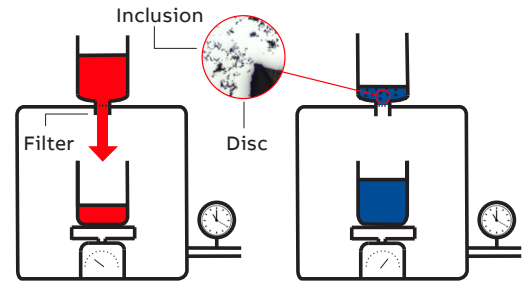
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### PoDFA technology

**Two simple steps: sampling and metallographic analysis**

A predetermined quantity of liquid aluminum is filtered under controlled conditions using a very fine porosity filter. Inclusions in the melt are concentrated at the filter surface by a factor of about 10,000. The filter, along with the residual metal, is then cut, mounted and polished before being analyzed under an optical microscope by a trained PoDFA metallographer.

The PoDFA technology has never been so accessible. All you have to do is take metal samples using the PoDFA-f system and then choose between two analysis options. You can either obtain a PoDFA license and perform your own metallographic analysis in house, or you can employ ABB's metallographic analysis service on a per-sample basis with no license fee. The second option enables you to access the PoDFA technology at your own pace and capacity.



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### PoDFA-f system

The PoDFA-f system includes all the equipment required for PoDFA sampling in molten aluminum: a PoDFA-f sampling station, a crucible heater, crucibles and filters as well as other facilitating tools described below. The equipment is compact, portable and economical. It can be easily installed where the sampling is conducted.

Sampling is straightforward: the operator pours some metal in a crucible, presses the start button and that's it! A vacuum forces the metal to flow through the porous filter. After the test, typically after five minutes, the metal sample is allowed to solidify and saved for metallographic analysis.



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01 Filter mounted  
on ceramic disk

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02 Metallographic  
analysis

### PoDFA reusable crucibles and filters

The PoDFA reusable crucible is designed to better meet the needs of cast houses and foundries by decreasing operational costs and labor time.

#### Filter on ceramic disk

We now offer filters mounted on a ceramic disk. These disks can reduce preheating time by 10 minutes and the use of an expandable material as gasket greatly reduces the risk of leak when pouring molten metal into the crucible.

The patented reusable crucible can last for up to 100 samples. It employs a ready-to-use filter for every test and can be installed in seconds. Thanks to this leading-edge design, filter detachment problems have been virtually eliminated as the filter is literally cast into the aluminum.

#### ABB PoDFA metallographic analysis service

You do the sampling; we take care of the analysis. Use a PoDFA-f system to take samples quickly and easily. Identify each metal residue indicating the sampling information and send all samples by express mail to our PoDFA metallographic analysis service. You will receive a report with key residue pictures and a breakdown of each inclusion type expressed in  $\text{mm}^2/\text{kg}$  of aluminum. All information is strictly confidential and reports are produced in less than two weeks. There is no license fee: you pay on a per-sample basis.



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PoDFA can effectively assess the effects of various operating practices and melt treatments on metal cleanliness. The histogram shown on the right is a good example of PoDFA results during the different stages of a process. Samples taken at the furnace exit contain high levels of carbides, magnesium oxides, refractory materials and oxide films. After degasser, the concentration of inclusions decreased while the concentration of oxide films increased, most probably due to excessive turbulence in the degassing chamber. Finally, results demonstrate that the ceramic foam filter is effective in removing both inclusions and oxide films. Inclusion concentrations decreased from about  $0.3 \text{ mm}^2/\text{kg}$  to less than  $0.1 \text{ mm}^2/\text{kg}$  and oxide films from about  $100/\text{kg}$  to less than  $10/\text{kg}$ .

#### Practical accessories

- Reusable crucible trolley for safe cooling and easy carrying
- Metal sample holder for safe aluminum residue cutting on a band saw



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01 Metallographic analysis results

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02 Metal sample holder

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03 Inclusion magnification

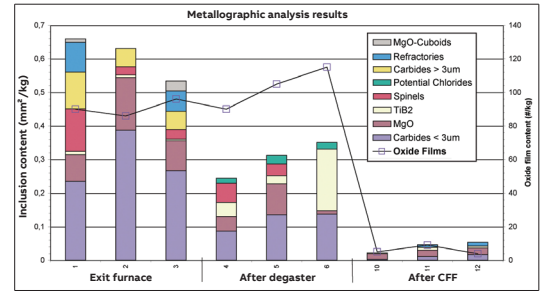
**Annual contracts for volume users**

Volume customers who regularly employ ABB’s PoDFA metallographic analysis services can take advantage of significant price reductions by signing an annual contract. Savings vary depending on the quantity, report content and sample preparation required. Annual contracts also offer an excellent alternative to licensed PoDFA users. As PoDFA metallographic analysis calls for expertise, time and accuracy, outsourcing to a highly specialized laboratory is the ideal solution for many aluminum plants.

**Rio Tinto Alcan metallographic analysis technology transfer**

PoDFA technology transfer and analysis trainings are available from ABB. For those who prefer to do more than just the sampling, the vast body of knowledge of Rio Tinto Alcan is readily transferable to your organization. It includes metallographic training and a CD-ROM that contains a catalog of inclusions as well as methods. This valuable information has been optimized for over 30 years by Rio Tinto Alcan on a wide variety of alloys.

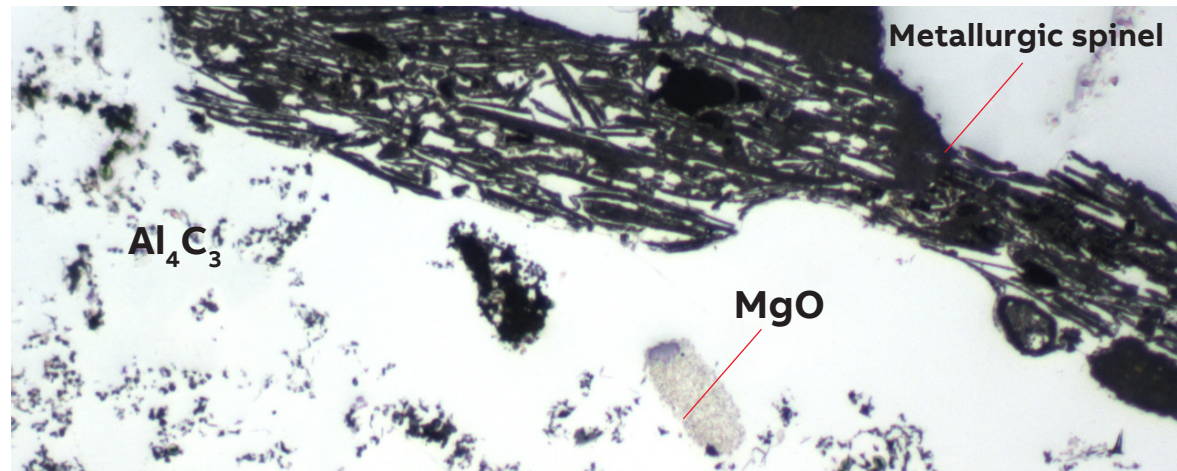
Standard and advanced PoDFA training sessions are available for PoDFA registered users.



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# Specification

## PoDFA-f sampling station

### Mass

Mass: up to 5 kg  $\pm$ 0.02 kg. **Important:** Mass over 8 kg can damage the load cell.

Target mass: Selectable to 1.50, 1.25 and 1.00 kg

Display: 3 ½ digits, 12.7 mm (0.56 in) high LEDs

### Electrical

Rated line voltage: 100 to 240 V AC

Rated line frequency: 50/60 Hz

Rated line power: 11 VA at 100 V, 34 VA at 240 V

Fuse type: T2A/250V

### Compressed air requirements

Inlet pressure: 5.5 to 8.25 bar (80 to 120 psig)

**Important:** To avoid damaging the solenoid valve, do not exceed 10 bar (150 psig)

Air purity: dry air, minimum dew point  $-40$  °C ( $-40$  °F). Clean, uncontaminated and filtered to 40  $\mu$ m or better.

Air temperature: below 35 °C (95 °F)

Air fitting: ¼ NPT female

Air consumption (at 100 psi) Vacuum: 340 l/min (12 SCFM)

Cooling: 665 l/min (23.5 SCFM)

### Physical

Overall dimensions (W × D × H):

33.0 × 29.5 × 39.4 cm (13.00 × 11.63 × 15.53 in)

Weight: 18.0 kg (39.5 lb)

### Environmental

Storage temperature:

$-10$  °C to 75 °C (14 °F to 167 °F)

Operating temperature:

10 °C to 50 °C (50 °F to 122 °F)

Storage humidity: Up to 60 % (non-condensing)

Operating humidity: Up to 90 % (non-condensing)

### Sound pressure level

Approximate instrument sound pressure level in vacuum mode

At the instrument: 118 dBA

At 1 m (39 in): 100 dBA

At 5.1 m (17 ft): 85 dBA

## PoDFA reusable crucible

### General

Heating time, on the heater: When heater is hot: 20 to 25 min (typical). When heater is cold: 30 min (typical). **Important:** Typical times based on normal room temperature, no forced convection around

the equipment and use of an insulation blanket over the crucible.

Lifetime: Up to 100 tests when following preparation and manipulation procedures described in the PoDFA-f system user's guide.

Protective coating needs to be redone every 15 to 20 tests. **Important:** Lifetime depends on the protective coating. Carefully follow the procedure described in the user's guide.

### Physical

#### Crucible

Outside diameter: 13.3 cm (5 ¼ in)

Height: 20.3 cm (8 in)

Weight: 1.36 kg (3 lb)

Materials:

- outer shell: carbon steel
- inner shell: stainless steel
- insulation: synthetic vitreous fiber (SVF) blanket

Packaging information: 3 crucibles per box

#### Filter

Materials:

- outer shell: aluminum and silica

Packaging information: 24 filters per box

### Environmental

Storage temperature:  $-10$  to 75 °C (14 to 167 °F)

Storage humidity: up to 60 %, non-condensing

### Crucible heater

#### Heating

Heating time: 0 to 6 hours (adjustable timer)

### Electrical requirements

Rated input voltage: 100 to 120/220 to 240 V AC (factory set)

Rated input frequency: 50/60 Hz

Earth leakage: less than 50 mA

Rated input current: 4 A at 230 V AC, 7 A at 115 V AC

Fuse type: T4A/250 V at 230 V AC, T7A/250 V at 110 V AC

### Environmental

Operating temperature: 10 to 50 °C (50 to 122 °F)

Storage temperature:  $-10$  to 75 °C (14 to 167 °F)

Operating humidity: up to 90 %, non-condensing

Storage humidity: up to 60 %, non-condensing

### Physical

Overall dimensions (H × W × D):

35 × 29 × 21 cm (13 ½ × 11 ½ × 8 ¼ in)

Weight: 5.6 kg (12 lb)



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