AnalyzeIT PoDFA

Inclusion identification and quantification analysis

The complete solution for inclusion measurement

Today’s global marketplace has compelled aluminum producers and aluminum 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.

PoDFA is a proprietary technology for melt cleanliness evaluation that provides information on the composition and concentration of the inclusions in molten aluminum. PoDFA has already demonstrated its great potential for process characterization and optimization, as well as product improvement. For example, you can quickly and accurately assess the effects of various operating practices on metal cleanliness or identify filtration efficiency. Using PoDFA is an essential key to producing high quality castings.
The complete solution for inclusion measurement

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.

1. PoDFA-f system

Portable low-cost equipment for molten aluminum sampling

The PoDFA-f system includes all the equipment required for PoDFA sampling in molten aluminum: a PoDFA-f sampling station, 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.

PoDFA reusable crucibles and filters

The PoDFA reusable crucible is designed to better respond to the needs of cast houses and foundries by decreasing operational costs and labor time. PoDFA users truly benefit from this innovative approach because it:

- Minimizes the cost per sample
- Significantly reduces the possibility of filter detachment
- Requires almost no preparation time

The patented reusable crucible is permanent and can last for up to 100 samples. It employs a new, ready-to-use filter for every test that can be installed in seconds. Thanks to this leading-edge design, the filter detachment problem has been virtually eliminated as the filter is literally cast into the aluminum. This feature is especially helpful for sampling pure or low-alloyed melts when filter detachment tends to occur more frequently.
2. PoDFA metallographic analysis

**ABB metallographic analysis service**

You do the sampling; we take care of the analysis.

Take samples quickly and easily using the PoDFA-f system. Identify each metal residue indicating the sampling information and then send all samples by express mail to our PoDFA metallographic analysis service. You will receive a report with the key residue pictures and a breakdown of each inclusion type expressed in mm$^2$/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.

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

**Practical accessories**

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

Alcan metallographic analysis technology transfer

Over 30 years of knowledge at your fingertips

PoDFA technology transfer and analysis training are available from ABB. For those who prefer to do more than just the sampling, the vast body of knowledge of 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 Alcan on a wide variety of alloys.

Additional PoDFA training

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

The PoDFA technology is the property of Alcan International Limited, and is licensed for manufacturing to ABB. Patent 5,827,982.

Reusable Crucible Patent Pending
Specifications

Inclusion identification and quantification analysis

PoDFA-f sampling station

Mass measurement
Mass 0 to 5 kg ± 0.02 kg

Important: Mass over 8 kg can damage the load cell

Target mass
Selective to 1.50, 1.25, and 1.00 kg

Display
3 1/2 digits, 0.56 in. (12.7 mm) high LEDs

Electrical
Rated line voltage
100 to 240 VAC (self adjusting)

Rated line frequency
50/60 Hz

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

Fuse type
T2A/250V

Compressed air requirements
Inlet pressure
80 to 120 PSIG

Important: To avoid damaging the solenoid valve, do not exceed 150 PSIG

Air purity
- Dry air, minimum dew point -40°C (-40°F)
- Air should be cleaned and uncontaminated
- Filtered to 40 microns or better

Air temperature
Below 35°C (95°F)

Air fitting
1/4 NPT female

Air consumption (at 100 PSI)
- Vacuum: 23.5 SCFM
- Cooling: 12 SCFM

Physical
Overall dimensions (WxDxH)
13 in. x 11.63 in. x 15.53 in.
(33 cm x 29.5 cm x 39.4 cm)

Weight
39.5 lb. (18.0 kg)

Environmental
Storage temperature range
-10°C to 75°C (14°F to 167°F)

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

Storage humidity range
Up to 60% (non condensing)

Operating humidity range
Up to 90% (non condensing)

Sound pressure level

<table>
<thead>
<tr>
<th>Distance from the instrument</th>
<th>Approximate sound pressure level in vacuum mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>at the instrument</td>
<td>118 dBA</td>
</tr>
<tr>
<td>at 1 m (39 in)</td>
<td>100.1 dBA</td>
</tr>
<tr>
<td>at 5.1 m (17 feet)</td>
<td>85 dBA</td>
</tr>
</tbody>
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Photos are courtesy of Alcan Inc.
Specifications

PoDFA reusable crucible and filter

**General**

**Crucible heating time on the crucible heater**
- When crucible heater is hot: Typically 20-25 minutes
- When crucible heater is cold: Typically 30 minutes

**Important:** Typical times are based on normal room temperature, no forced convection around the equipment and the use of an insulation blanket over the crucible.

**Crucible lifetime**
Up to 100 tests when following the proper preparation and manipulation procedure described in the PoDFA-f System User’s Guide

**Crucible protective coating**
Needs to be redone every 15 to 20 tests

**Important:** Crucible lifetime is dependent on the protective coating. Carefully follow the procedure described in the User’s Guide.

### Physical

<table>
<thead>
<tr>
<th></th>
<th>Crucible</th>
<th>Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall dimensions</strong></td>
<td>OD: 5-1/4 in. (13.3 cm)</td>
<td>OD: 1-1/2 in. (3.8 cm)</td>
</tr>
<tr>
<td></td>
<td>Height: 8 in. (20.3 cm)</td>
<td>Thickness: 1/4 in. (0.6 cm)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>3 lb (1.36 kg)</td>
<td>1 oz (30 g)</td>
</tr>
</tbody>
</table>

**Materials**

- Outer shell: Carbon steel
- Inner shell: Stainless steel
- Insulation: Synthetic Vitreous Fiber (SVF) blanket

**Packaging information**
3 crucibles per box, 24 filters per box

### Environmental

**Storage temperature range**
-10°C to 75°C (14°F to 167°F)

**Storage humidity range**
Up to 60% (non condensing)

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**Crucible Heater**

**Heating time**
0 to 6 hours (adjustable timer)

**Electrical requirements**

- **Rated input voltage**: 100-120 / 220-240 VAC (factory set)
- **Rated input frequency**: 50 / 60 Hz
- **Earth leakage**: Less than 50mA
- **Rated input current**: 4A at 230 VAC, 7A at 115 VAC

**Fuse type**
T4A/250V at 230 VAC, T7A/250V at 110 VAC

### Environmental

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

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

**Operating humidity**
Up to 90% (non condensing)

**Storage humidity**
Up to 60% (non condensing)

### Physical

**Dimensions**
13-1/2 in. H x 11-1/2 in. W x 8-1/4 in. D
(35 cm H x 29 cm W x 21 cm D)

**Weight**
12 lb. (5.6 kg)