

OPTICAST™

RAPID ALUMINIUM SAMPLE PREPARATION SYSTEM

A simplified version of the well-established Opticast system for characterisation and optimisation of grain refinement in aluminium casthouses has been developed for facilitating rapid preparation of aluminium samples for measurement of grain size.

Features

- Lightweight, portable equipment which can be set up on a typical desk top provides all functions necessary for rapid sample preparation
- The system is robust and simple to operate
- All timings for the anodising , rinsing and polishing of samples can be pre-set on the Optipower controller
- Audible signals alert the operator to the completion of each stage
- Polishing and anodising liquids are safely stored and dispensed internally in the Opticube polishing unit

Benefits

- Sample preparation completed in 3 -5 minutes
- Surface finish allows direct and accurate determination of grain size with polarizing microscope
- Can be set up in an area close to the casting pit

Description of equipment and operation

The Opticast equipment is designed for rapid preparation of aluminium samples grain size measurements, see figure 1.

Figure 1. Opticast system



- A – Optipower Power unit
 B – Opticube polishing/anodizing station
 C – Communication cable between Optipower and Opticube
 D – Sample holder

The equipment prepares aluminium samples for metallographic examination by electrolytic polishing and anodizing with intermediate rinsing steps between. It is primarily developed for grain size measurements and is not suitable for studies of intermetallic particles or porosity.

Since silicon is etched away in the polishing process, the maximum recommendable Si content in the alloy to be prepared is about 2%. However, aluminium alloys with high silicon contents can be anodized with the equipment.

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Optipower

The Optipower unit sets the parameters for the electrolytic processes in Opticube, see figure 2.



Figure 2. Optipower

In the Optipower control unit the times for the electrolytic processes are set by thumb wheels. Polishing time can be set in the range of 0 – 99 seconds and anodizing can be set from 0 to 999 seconds. Typical polishing times for most materials are in the range of 30 to 60 seconds and anodizing times are normally 100 – 150 seconds.

The Opticube contains two tanks for the electrolytes. These liquids are pumped against the sample and the flow rates are set on the Optipower unit. The system also contains a rinsing step and the rinsing time can be set from 1 – 20 seconds.

The Optipower contains a 50 V power unit for the electrolytic processes. This is a constant voltage which means that the current will vary in the electrochemical processes which can be followed by the ampere meter. The absolute value of the current depends on the electrolytes used, their type and condition. Furthermore the current is also dependent on the porosity of the sample, the flow rate and aluminium alloy type.

Opticube

Figure 2. Optipower



a) Front view

b) Back View

c) Top view

The Opticube contains two tanks which are filled with electrolytes through the openings at the top, see figure 3 c), 1 and 3. The tanks can be emptied through the two hose connectors at the front of Opticube, seen in the front view of the apparatus, figure 3 a). On the hose connector there are normally connected with hoses attached to valves, but these are not shown in the picture. Opening 3 is the rinsing station.

The Opticube is connected to the Optipower unit via a communication cable (see figure 1 C) and is plugged into the socket at the back of the machine. The sample holder (see figure 1 D) is normally mounted on the Opticube but can easily be detached from it. The Opticube has three stations: polishing, rinsing and anodizing (3, 2 and 1 in figure 3c).

The apparatus contains two acid resistant pumps and a water valve for the rinsing station. The rinsing station can be directly connected to normal water supplies since it can operate to pressures up to 10 bars. The water is connected to the upper hose connector on the back side and the outlet water is drained through the lower hose connector, see figure 3 b).

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Sample holder

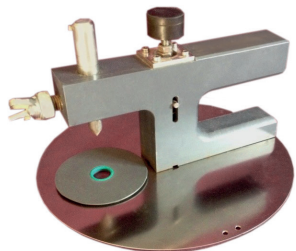


Figure 4. Sample holder

The sample holder is normally mounted on top of the Opticube but can be removed if necessary. Samples are fastened with a spring loaded needle onto the circular plastic disc with a hole enclosed by an O-ring.

The plastic disc can be delivered with any form and size of the hole, up to 30 mm in diameter, the hole in the disc seen in the picture is 14 mm. In principle, the whole prepared area can be examined with a microscope. The maximum height of the sample that can be mounted in the sample holder is 45 mm and samples can be prepared 35 mm in from the surface.

During the preparation the sample holder is manually moved to the three stations and it locks into position over respective station on the Opticube.

The sample holder can be tailored to fit any size of sample. However, if there is a request for preparation of very large samples, special stands must be constructed. With the current sample holder, 45 mm thick billets slices of a diameter of 381 mm have been prepared, 35 mm in from the outer surface of the billet.

Standard operating practise

Preparation of sample

In principle any raw flat surface can be prepared but the quality of preparation improves the finer the initial preparation is. A higher quality preparation also simplifies the grain size measurement.

It is recommended that the surface is grinded down to a fineness of at least 320 mesh.

Typical preparation cycle

- The sample is clamped on to the sample holder
- The sample holder is moved to the polishing station and the Polishing button is pressed.
- The polishing sequence can range from 10 -99 seconds, the short time for very fine surfaces and the long time for very coarse surfaces. Typical time for a 320 mesh surface is 40 seconds.
- The sample holder is moved to the rinsing station and is rinsed between 1 to 20 seconds when the Rinsing button is pressed. The rinsing time is pre-set inside the Optipower box and typical rinsing time is 10 seconds.
- After rinsing the sample holder is moved to the anodizing station and the Anodizing button is pressed. Typical anodizing time is 50-200 seconds, depending on alloy and status of anodizing liquid.

Electrolytes

The following two liquids are used in the process:

- A2 for polishing
- 5 % HBF4 for anodizing

MSDS's and instructions for mixing and handling the liquids are provided separately. The Opticube contains 1 litre of each liquid and at least 1000 samples can be prepared with each liquid before it must be changed.

Technical Data

Power supply

50/60 Hz, 100-240V

Output Voltage/Current

Polishing: 50V / 0.5 - 2 A
Anodizing: 50V / 0.05 - 1 A

Dimensions and Weights

Control unit

Depth: 320 mm
Width: 410 mm
Height: 120 mm
Weight: 6.0 kg

Cable between control unit and polishing/anodizing unit

Length: 1.5 meter (can be designed in any length)
Weight: 0.6 kg

Polishing/Anodizing unit

Depth: 280 mm
Width: 280 mm
Height: 250 mm, 360 mm with sample holder mounted
Weight: 10.6 kg

Water

Operating pressure: 3-10 bars