ANODIZING OF PRECISION-MILLED PLATES FROM HABA

THE ANODIZING GUIDE

HABA
Solutions in plates

1. INTRODUCTION

The demands on the surface quality of components are constantly increasing. At HABA, we attach particular importance to meeting these requirements. With selected input materials and a manufacturing process that is based on the latest melting and casting technology, we can supply material from casting ingots that are unique in the world. Thanks to our long-standing network of suppliers, we support our customers at all times in selecting the right material in line with market requirements.

2. ADVANTAGES OF (PRECISION-MILLED) HABA HC CAST PLATES

The use of cast material offers numerous advantages and, in combination with balanced heat treatment to homogenize the structure and stress relief annealing, ensures the best possible dimensional stability of the components.

Weitere Vorteile:

- Highest demands on machinability and dimensional stability
- Fine-grained and homogeneous microstructure that enables optimized machining parameters.
- HABA factory standards guarantee consistent material quality over many casting batches.
- Gas and vacuum tightness is many times better thanks to low microporosity.
- Very good machining properties (short chip formation)

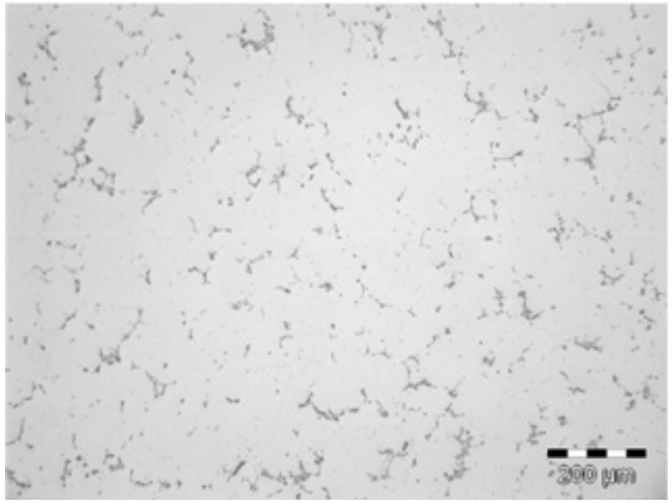

Figure 1: Homogeneous microstructure of HABA HC5083 cast iron with uniformly fine grain structure

3. SPECIAL REQUIREMENTS FOR SURFACE TECHNOLOGY WHEN USING CAST PLATES

In order to be able to utilise the unique properties of HABA HC cast alloy qualities technologically, some information and instructions on the correct handling of these materials are required:

DIFFERENCES BETWEEN CAST AND ROLLED PLATES

Due to the forming process, naturally hard aluminium rolled plates have excellent ductility and a particularly dense and low-porosity structure. With greater thicknesses, however, differences in microstructure occur due to the material not being fully wrought through the thickness. This effect becomes most obvious when comparing the mechanical properties of rolled plates with increasing thickness. The coarsening of the microstructure is accompanied by decreasing mechanical properties or becomes visible through colour gradients after anodising.

On the other hand, such materials behave inconspicuously during chemical treatment. Uniform material removal and practically negligible pore formation allow large process windows with low sensitivity of the material.

High-quality cast ingots are characterised by a uniform microstructure across the entire cross-section. The blocks used for the production of HABA HC grades are limited in thickness to 270 mm due to the process.

The lack of forming in HABA HC grades and the extensive homogenisation and annealing process allow the production of extremely low-stress material. Nevertheless, some information is required:

- Due to the cast structure, HABA HC grades react much more sensitively to chemical pre-treatment processes.
- Pickling to size or to dimension should always be avoided due to the treatment times required.
- Chemical pre-treatment should be reduced to the necessary minimum.

DEFECTS DUE TO OVERLY INTENSIVE CHEMICAL PRE-TREATMENT:

- Long pickling times or pickling with concentrated alkaline solutions lead to a roughening of the surface. This leads to a matt or dull appearance of the surface. (see picture 2)

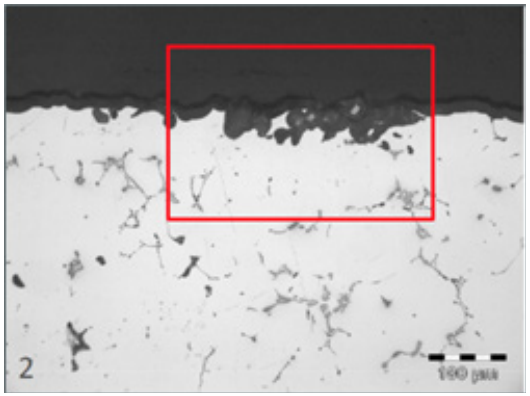

Figure 2: Surface roughened by intensive chemical pre-treatment

- Long treatment times in the baths can lead to localised pitting and pore formation. These areas become visible as white spots, especially after the application of dark-coloured anodised layers. (see picture 3)

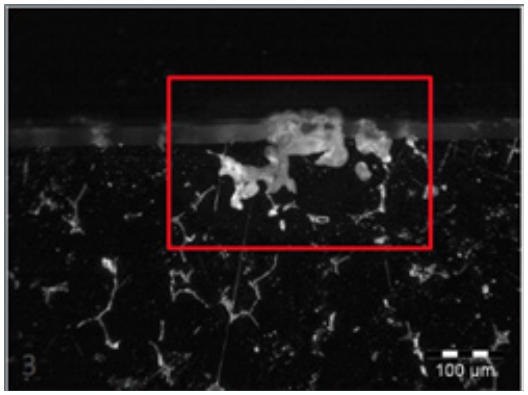

Figure 3: Pitting due to heavy pickling. Large areas of the aluminium casting structure have disintegrated.

Our HABA HC grades are subject to close quality control. A large number of microstructure samples are taken from all cast batches. This ensures that only material with the best possible microstructure quality reaches the customer. The correct handling of these material qualities allows the economical production of components with unique surfaces. Communication regarding the material quality used is indispensable along the entire value chain! This is the only way to achieve the best possible results in a reliable process.

The following table summarises our recommendations from more than 20 years of experience in the use of cast materials.

We will be happy to assist you with our expertise in your project.

4. TYPICAL PROCESS PARAMETERS FOR CAST PLATES:

Process steps		Description
1.	Degreasing	Degreasing should be carried out with superheated steam; if alkaline agents are used, a short immersion time at a moderate temperature should be selected. Water with wetting agents or suitable anodising cleaners can also be used. Please follow the manufacturer‘s instructions. Immersion times of up to a maximum of 5 minutes at 60°C have proved effective. Degreasing must be matched to the surface pre-treatment: degreasing is sufficient for exclusively mechanical processing (e.g. grinding or polishing), while intensive mechanical processing or brushing should be pre-treated with diluted pickling agents.
2.	Pickling	Should always be avoided with cast material. An attack on the grain boundaries leads to corrosion. If the anodised material is heavily contaminated, brief immersion in an alkaline solution (NaOH, approx. 5%, max. 30 seconds) is recommended. For decorative applications (alloy EN AW-5754), alkaline treatment should be avoided completely; when using 7000 series alloys, alkaline treatment should only be used if absolutely necessary.
3.	Rinsing	Rinsing should only be carried out with deionised water.
4.	Decapping	Carried out at room temperature in a 20% nitric acid solution. Buffered acid mixtures based on sulphuric acid have also proved effective. Immersion time approx. 30 seconds.
5.	Rinsing	Rinsing should only be carried out with deionised water.
6.	Anodic oxidation	Richtwerte: Standard values: Sulphuric acid-water electrolyte: 15 - 20% (180 - 220 g/l) Voltage: 12 - 20 V (15 V) Current density: 1.0 - 2.0 A/dm^2 (1.5 A/dm^2) Temperature: 15 - 22°C 30 - 60 minutes, depending on the desired layer thickness
7.	Rinsing	Rinsing should only be carried out with deionised water.
8.	Neutralisation	In demineralised water, if necessary with sodium carbonate (Na2CO3) or sodium hydrogen carbonate (NaHCO3). The pH value of the neutralisation bath must be checked regularly (carry-over of electrolyte)
9.	Rinsing	Rinsing should only be carried out with deionised water.
10.	Colouring	According to the dye manufacturer‘s instructions (use suitable, colourfast anodising dyes). Not applicable for Natureloxal
11.	Rinsing	Rinsing should only be carried out with deionised water.
12.	Sealing	In fully demineralised hot water

5. ANODISING ALUMINIUM

Aluminium forms a natural oxide layer when exposed to air. This process is known as autoxidation; the thickness of this natural oxide layer is 1 to 3 µm. This oxide layer must be completely removed before technical surface treatment. Depending on the manufacturing process, semi-finished products also need to be degreased. These pre-treatments remove oil and grease residues as well as thicker oxide layers, such as those produced during hot forming or heat treatment. Aluminium is pickled in alkaline or acidic solutions.

6. SURFACE PRE-TREATMENT

There are numerous mechanical pre-treatment processes for the surface treatment of anodised aluminium. A distinction is made between mechanical and chemical processes.
Mechanical processes include grinding, polishing or brushing. Chemical processes include matting or polishing. These two processes allow the production of particularly high-quality surface properties. The pre-treatment processes are labelled as follows:

E0	**without pre-treatment**	**E4**	**ground and brushed**
E1	**sanded**	**E5**	**ground and polished**
E2	**brushed**	**E6**	**chemically matted**
E3	**polished**		

7. DEGREASING BEFORE PICKLING

Degreasing is carried out with the aid of chemical additives to remove, among other things, emulsion residues from the processing. Particular attention should also be paid to adhesive residues (e.g. labels). If acidic or alkaline additives are used, ensure thorough neutralisation.

8. PICKLING IN CAUSTIC SODA

This process step is carried out in an aqueous solution of sodium hydroxide (NaOH, caustic soda). In the case of cast materials, this process step must be kept as short as possible due to the greater sensitivity of the cast structure. This is also important for the designer, as pickling to size can lead to damage to the microstructure. These defects only become visible after colouring and sealing.

9. STANDARD COLOUR FAN

Information on the colour fan ‘EURAS - Standard’ (European Association of Anodisers):

C-0	colourless	C-33	medium bronze
C-31	soft bronze	C-34	dark bronze
C-32	light bronze	C-35	black

10. IMPORTANT INFORMATION FOR MECHANICAL PROCESSORS AND ANODISING COMPANIES

When ordering, the following information is crucial for good anodising results

Processor (important information):

- Alloy (5083/5754/6082 etc. / what material is it?)
- Cast or rolled plate
- Dimensional or decorative anodising

Anodising operation (important to note):

- What material is involved?
- Alloy 5754 is used in most cases for decorative applications
- Cast 5754 only foam pickling
- If you are unsure, please contact us

Other influences on the optical quality

The machining and subsequent storage of the aluminium parts can have an influence on the appearance of the anodised layer.
Even slight corrosion caused by a cooling lubricant with the wrong pH value can lead to visible defects in the oxide layer.
If high demands are placed on the optical quality of the parts, we recommend close monitoring of all parameters and auxiliary materials.

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Literature:

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15. Auflage. Aluminium – Merkblatt O4, Aluminium-Zentrale e.V., Düsseldorf
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