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**Technical specification for surface treatment of
titanium alloy castings**

钛合金铸件表面处理技术规范

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Table of Contents

Foreword.....	3
1 Scope.....	4
2 Normative references.....	4
3 Surface treatment	4
4 Quality inspection.....	9
5 Quality control	11
6 Technical safety	12

Technical specification for surface treatment of titanium alloy castings

1 Scope

This Standard specifies surface treatment, quality inspection, quality control and technical safety of surface of titanium and titanium alloy castings.

This Standard is applicable to surface treatment of titanium and titanium alloy castings produced by graphite processing molds, sand molds, metal molds and investment casting molds.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 337.1, *Concentrated nitric acid for industrial use*

GB/T 4698.15, *Methods for chemical analysis of titanium sponge, titanium and titanium alloys - Determination of hydrogen content*

GB/T 5750.1, *Standard Examination Methods for Drinking Water - General Principles*

GB/T 6614, *Titanium and titanium alloy castings*

GB/T 7744, *Hydrofluoric Acid for Industrial Use*

3 Surface treatment

3.1 Sandblasting

3.1.1 General requirements

3.1.1.1 The gas used for drying, sandblasting or other processes shall be dehydrated and de-oiled.

3.1.1.2 During the sandblasting process and the processing operations of the

v - Corrosion rate, in milligrams per square millimeter hour [$\text{mg}/(\text{mm}^2 \cdot \text{h})$];

Δm – Mass loss, in milligrams (mg);

δ_0 - Original thickness, in millimeters (mm);

m_0 - Original mass, in milligrams (mg).

3.2.4.4 Rinse with water after pickling. Washing temperature: below temperature for cold water, $30^\circ\text{C} \sim 60^\circ\text{C}$ for warm water. Washing water resistivity $\geq 1200 \Omega \cdot \text{cm}$ (25°C). Total soluble solids (TDS) $\leq 600 \text{mg/L}$. PH value is 5.5~8.5 (generally tap water requirements). The determination method is according to GB/T 5750.1. Ensure that there is sufficient water flowing into the cleaning tank. It shall be rinsed in the final stage of cleaning to ensure that the casting surface is not contaminated.

3.2.4.5 Blow dry with clean, oil-free dry compressed air, or dry in an oven. Put on clean gloves to remove the casting. Use clean packaging materials to protect castings.

3.2.5 Pickling solution preparation, analysis, maintenance and adjustment

3.2.5.1 When preparing the solution, add chemicals according to the ratio. Stir evenly after preparation. The depth of the tank solution is generally not more than two-thirds of the depth of the tank.

3.2.5.2 The concentration of titanium ions in acid solutions shall be analyzed regularly. The interval period generally does not exceed 4 weeks. It can use inductively coupled plasma atomic emission spectrometer to analyze.

3.2.5.3 Adjust the solution according to the analysis result of the solution. Adjust according to the composition specified in 3.2.3.1. Add the required amount after the loss of each component. Then stir well.

3.2.5.4 If the titanium ion content in the pickling solution is more than 25g/L and the pickling rate cannot meet the demand, the pickling liquid shall be scrapped. The waste pickling liquid shall be packed into a sealed container and transported to a qualified professional institution for disposal. The emissions shall not be handled by themselves.

3.2.6 Purification of acid gas

The acid gas generated during the pickling process shall be purified before being discharged into the atmosphere. Discharge only after meeting environmental discharge standards.

4 Quality inspection

4.1 Sandblasting quality

The castings after sandblasting shall meet the following requirements:

- a) The surface roughness shall reach $Ra3.2\mu m \sim Ra12.5\mu m$.
- b) The surface roughness shall be uniform and free of scale, no sandblasting debris, no discoloration, no oily materials, no fingerprints and other contaminants.
- c) If the above situation occurs, it shall be sandblasted again.
- d) When the casting is deformed, it shall be sandblasted again after correction.
- e) The abrasive used for sandblasting shall be checked regularly and meet the requirements of 3.1.2. If it does not meet the requirements, the blasting material shall be replaced.

4.2 Pickling quality

4.2.1 Appearance

4.2.1.1 The surface quality of the pickled castings shall be 100% visually inspected. The surface shall be smooth, with metallic luster or silvery white or off-white.

4.2.1.2 The surface of the casting shall not have corroded defects such as pits or spots that have not been washed away by acid.

4.2.1.3 There shall be no oil stains, handprints, seal marks and handwriting on the surface of the casting.

4.2.1.4 There shall be no mechanical damage such as pressure pits, bumps, and scratches on the surface of the casting.

4.2.2 Hydrogen content and increase in hydrogen

4.2.2.1 Under the condition of ensuring the composition of the tank liquid and the specified temperature, pickling shall not exceed the prescribed time to avoid adding more hydrogen. The hydrogen increase shall be checked regularly. The thickness of the annealed ZTC4 alloy test piece is 1mm~1.5mm, and the weight is about 0.3g. When each side is pickled at 0.025mm, the hydrogen increase shall not exceed 0.003%. When the hydrogen increase exceeds 0.003%, production shall be stopped immediately and the cause shall be found.

discoloration, oily materials, fingerprints or other contaminants.

- b) Immerse in pure water with a resistivity of not less than $50\Omega\cdot\text{m}$ for several seconds. After being taken out of the water, there shall be no water film broke on the surface.
- c) If the above situation occurs, clean it again.
- d) The casting must not be deformed during the sandblasting process.
- e) The blasting material used for blasting shall be checked regularly to ensure that it meets the requirements.

5 Quality control

5.1 Equipment and instruments

5.1.1 The equipment and instruments shall have certificates. Perform verification or calibration according to the specified cycle.

5.1.2 The equipment and instruments that have not been verified or calibrated, have failed verification, and have exceeded their effective period of use shall not be used.

5.2 Workshop environment

5.2.1 The workshop casting warehouse shall be isolated from the production room to prevent corrosion of the castings.

5.2.2 In addition to effective air intake and exhaust systems, the workshop shall also have good natural ventilation.

5.2.3 The workshop shall have good natural light or lighting. Local lighting shall be provided for inspection and other important work stations in the workshop.

5.2.4 The workshop production site shall be kept clean and tidy. The main pickling tank shall be covered when it is not working. Bridge plates shall be placed between each pickling tank to prevent the solution from dripping on the ground.

5.2.5 In the design of the new plant, the workshop temperature shall not be lower than 12°C , the temperature of the workshop laboratory shall not be lower than 18°C , and the ambient noise of the workshop shall be controlled below 85dB.

5.3 Crafting process

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