Introduction

Titanium, which was found in the 1790s, is the 4th most abundant practical metal existing in the upper crust of the earth. It has taken a long time before an industrial refining process for titanium was reached to completion, and not until 1946 did industrial production of this new metal, titanium begin. The metal was adopted for aerospace applications for the beginning, owing to its specific strength. And then, the demand for titanium, which also has outstanding corrosion resistance, began to increase markedly for such applications as Chemical industries and Electric power generation. Today, titanium is a well-known material for its character from aesthetic and for environmental and biological conformity. Titanium, which has excellent physical properties and is friendly to the environment, meets contemporary needs from the world and has a great potential for an expected growth in the future.

NIPPON STEEL, which was founded in 2012 as a world top-class comprehensive producer of titanium mill products, supplies its high-function, high-quality products and services to the customers by utilizing the best effectiveness of the consolidated management resources of the new corporation and the specialized expertise of the companies.

Based on the results of basic studies of titanium which has been obtained for many decades, with its more strengthened organization and staffs of research and development, we continue R&D for various fields of titanium application, such as Chemical industries, Electric power generation, Seawater desalination, Civil engineering, Architecture, Automotive, Consumer appliances, and Aerospace industries, etc. We are also developing new applications of titanium actively aiming to customers’ needs.

NIPPON STEEL is to pursue the infinite potential of the contemporary metal, “Titanium”.

CONTENTS

Introduction

Characteristics of Titanium

Titanium Production Flowchart

Hot and Cold Rolled Coils / Sheets

Titanium Foils

Plates

Welded Tubes and Pipes for Heat Exchanger

Welded Tubes and Pipes for Plumbing

Wire Rods and Bars

Examples of Applications of Titanium

Standards of Titanium Products

Physical Properties

Corrosion Resistance

Tensile Properties in High Temperature

Clarke Number

Sites of Manufacturing and R&D

Notice

While every effort has been made to ensure the accuracy of the information contained within this publication, the use of the information is at the reader’s risk and no warranty is implied or expressed by NIPPON STEEL CORPORATION with respect to the use of the information contained herein. The information in this publication is subject to change or modification without notice. Please contact the NIPPON STEEL CORPORATION office for the latest information.

Please refrain from unauthorized reproduction or copying of the contents of this publication.

The names of our products and services shown in this publication are trademarks or registered trademarks of NIPPON STEEL CORPORATION, affiliated companies, or third parties granting rights to NIPPON STEEL CORPORATION or affiliated companies. Other product or service names shown may be trademarks or registered trademarks of their respective owners.
Titanium Production Flowchart

Rutile (raw material) → Sponge → Slab → Plate-rolling → Finishing → Plate

Recycled raw materials → Slab → Hot rolling → Hot rolled coil → Cold rolling → Cold rolled coil

Alloying elements → Ingot → Melting → Sponge → Slabbing/billetting → Slab → Plate-rolling → Finishing → Plate

Cold rolled coil → Welded tube line → Welded tube

Cold rolled coil → Cold rolled cut-length sheet

Pressing → Slabbing/billetting → Billet → Forging → Bar rolling → Conditioning → Bar

Rolling → Wire rod
**Hot and Cold Rolled Coils / Sheets**

**Applicable standards**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIS H 4600</td>
<td>Class 1, Class 2, Class 3, Class 4, Class 11, Class 12, Class 13, Class 17, Class 19, Class 20, Class 21, Class 22</td>
</tr>
<tr>
<td>ASTM B265</td>
<td>Gr.1, Gr.2, Gr.3, Gr.4, Gr.7, Gr.11, Gr.13, Gr.14, Gr.16, Gr.17, Gr.30, Gr.31</td>
</tr>
<tr>
<td>ASME SB 265</td>
<td>Gr.1, Gr.2, Gr.3, Gr.4, Gr.7, Gr.11, Gr.13, Gr.14, Gr.16, Gr.17, Gr.30, Gr.31</td>
</tr>
<tr>
<td>AMS</td>
<td>AMS4900, AMS4901, AMS4902</td>
</tr>
</tbody>
</table>

**Company specifications**

- Ti-20V-4Al-15Sn (β alloy), Ti-3Al-5V(α+β alloy)
- Well-formable grade, Super-TiX™10CU, Super-TiX™10CUNB, Super-TiX™800, Super-TiX™51AF (Hot rolling, α+β alloy)

**Surface finish**

- Vacuum annealing / Annealing & pickling ※ Please consult us for any other surface finish.

**Available sizes**

- Hot-rolled, Cold-rolled

---

**Titanium Coils / Sheets for Architecture**

**Applicable standard**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIS H 4600</td>
<td>Class 1 equivalent</td>
</tr>
</tbody>
</table>

**Surface finish**

- Dull finish, Blasting finish, Coloring finish

**Available sizes**

- Please consult us for other sheet sizes.

(Note 1) For JIS Class 3 (ASTM Gr. 3) or higher grades, please consult us when placing an order.

---

**Titanium Foils**

**Applicable standards**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIS H 4600</td>
<td>Class 1 equivalent, Class 2 equivalent</td>
</tr>
<tr>
<td>ASTM B265</td>
<td>Gr.1 equivalent</td>
</tr>
<tr>
<td>ASME SB 265</td>
<td>Gr.1 equivalent</td>
</tr>
</tbody>
</table>

**Available sizes**

- Subject to consultation

(Note 1) For JIS Class 3 (ASTM Gr. 3) or higher grades, please consult us when placing an order.
### Plates

#### Applicable standards
- JIS H 4600
- ASTM B265
- ASME SB 265

#### Surface finish
- Pickling, Polishing

#### Available grades and size range

<table>
<thead>
<tr>
<th>Available grades</th>
<th>JIS TP270H</th>
<th>ASTM Gr.1</th>
<th>ASME Gr.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness(㎜)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60.0≦ t</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.0≦ t&lt; 60.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0≦ t&lt; 40.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0≦ t&lt; 15.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0≦ t&lt; 7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5≦ t&lt; 6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0≦ t&lt; 5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0≦ t&lt; 5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product width(㎜)</th>
<th>1000</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
<th>3500</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness(㎜)</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60.0≦ t</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.0≦ t&lt; 60.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0≦ t&lt; 40.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0≦ t&lt; 15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0≦ t&lt; 7.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5≦ t&lt; 6.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0≦ t&lt; 5.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0≦ t&lt; 5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Available grades</th>
<th>JIS TP340H</th>
<th>ASTM Gr.2</th>
<th>ASME Gr.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness(㎜)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60.0≦ t</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.0≦ t&lt; 60.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0≦ t&lt; 40.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0≦ t&lt; 15.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0≦ t&lt; 7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5≦ t&lt; 6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0≦ t&lt; 5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0≦ t&lt; 5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product width(㎜)</th>
<th>1000</th>
<th>1500</th>
<th>1800</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
<th>3500</th>
<th>4000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness(㎜)</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60.0≦ t</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.0≦ t&lt; 60.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0≦ t&lt; 40.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0≦ t&lt; 15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0≦ t&lt; 7.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5≦ t&lt; 6.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0≦ t&lt; 5.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0≦ t&lt; 5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Available grades</th>
<th>JIS TP550H</th>
<th>ASTM Gr.4</th>
<th>ASME Gr.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness(㎜)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60.0≦ t</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.0≦ t&lt; 60.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0≦ t&lt; 40.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0≦ t&lt; 15.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0≦ t&lt; 7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5≦ t&lt; 6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0≦ t&lt; 5.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0≦ t&lt; 5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Available grades
- JIS TP480H
- JIS TP480PdH
- ASTM Gr.3
- ASME Gr.3

### Surface finish
- Pickling, Polishing

### Available grades
- JIS TP270H
- JIS TP270PdH
- ASTM Gr.1
- ASME Gr.1

### Available grades
- JIS TP340H
- JIS TP340PdH
- ASTM Gr.2
- ASME Gr.2

### Available grades
- JIS TP550H
- JIS TP550PdH
- ASTM Gr.4
- ASME Gr.4

(Note) The maximum product length is 10000 mm (10 m).
Please consult us for products whose length is in the range 10000~14000 mm.

Available size range: Please consult us when placing an order.
### Welded Tubes and Pipes for Heat Exchanger

**Applicable standards**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIS H 4631</td>
<td>Class 1, Class 2, Class 3, Class 11, Class 12, Class 17, Class 19, Class 21, Class 22</td>
</tr>
<tr>
<td>JIS H 4635</td>
<td>Class 1, Class 2, Class 3, Class 11, Class 12, Class 17, Class 19, Class 21, Class 22</td>
</tr>
<tr>
<td>ASTM B338, B862</td>
<td>Gr.1, Gr.2, Gr.3, Gr.7, Gr.11, Gr.13, Gr.14</td>
</tr>
<tr>
<td>ASME SB338, SB862</td>
<td>Gr.1, Gr.2, Gr.3, Gr.7, Gr.11, Gr.13, Gr.14</td>
</tr>
<tr>
<td>Company specifications</td>
<td>Super-TIX™10CU, Super-TIX™10CUNB</td>
</tr>
</tbody>
</table>

**Available sizes**

<table>
<thead>
<tr>
<th>Outside diameter (㎜)</th>
<th>Thickness (㎜)</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>1.0</th>
<th>1.2</th>
<th>1.4</th>
<th>1.6</th>
<th>2.0</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>#12.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#15.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#18.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#21.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#24.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#27.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#29.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>#31.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>#31.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#33.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#34.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#35.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#38.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#41.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#42.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#45.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#47.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#50.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#55.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#60.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*●*: Scope of consultation

Sizes other than those shown above may be made available when requested. For the available sizes of high-strength products of Class 3 or higher, please consult us.

### Welded Tubes and Pipes for Plumbing

**Applicable standards**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIS H 4631</td>
<td>Class 1, Class 2, Class 3, Class 11, Class 12, Class 17, Class 19, Class 21, Class 22</td>
</tr>
<tr>
<td>JIS H 4635</td>
<td>Class 1, Class 2, Class 3, Class 11, Class 12, Class 17, Class 19, Class 21, Class 22</td>
</tr>
<tr>
<td>ASTM B338, B862</td>
<td>Gr.1, Gr.2, Gr.3, Gr.7, Gr.11, Gr.13, Gr.14</td>
</tr>
<tr>
<td>ASME SB338, SB862</td>
<td>Gr.1, Gr.2, Gr.3, Gr.7, Gr.11, Gr.13, Gr.14</td>
</tr>
<tr>
<td>Company specifications</td>
<td>Super-TIX™10CU, Super-TIX™10CUNB</td>
</tr>
</tbody>
</table>

**Available sizes**

<table>
<thead>
<tr>
<th>Outside diameter (㎜)</th>
<th>Thickness (㎜)</th>
<th>1.0</th>
<th>1.2</th>
<th>1.5</th>
<th>2.0</th>
<th>3.0</th>
<th>4.0</th>
<th>5.0</th>
<th>6.0</th>
<th>8.0</th>
<th>10.0</th>
<th>12.0</th>
<th>14.0</th>
<th>16.0</th>
<th>18.0</th>
<th>20.0</th>
<th>24.0</th>
<th>28.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>#13.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#17.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#19.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#21.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#25.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#27.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#34.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#38.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#41.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#42.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>#45.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>#48.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>#50.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#55.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#60.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*●*: Scope of consultation

Sizes other than those shown above may be made available when requested. For the available sizes of high-strength products of Class 3 or higher, please consult us.
Wire Rods and Bars

### Applicable standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent of JIS H 4650 H4670</td>
<td>Class 1, Class 2, Class 3, Class 4, Class 11, Class 12, Class 13, Class 81</td>
</tr>
<tr>
<td>Equivalent of ASTM B348-B863</td>
<td>Gr.1, Gr.2, Gr.3, Gr.4, Gr.7, Gr.9(Ti-3Al-2.5V), Gr.19(Ti-3Al-8V-6Cr-4Mo-4Zr)</td>
</tr>
<tr>
<td>Company specifications</td>
<td>Super-TIX™800, Super-TIX™51AF, Super-TIX™523AF, 15-3-3-3 equivalent</td>
</tr>
<tr>
<td>JIS H 4650</td>
<td>Class 1, Class 2, Class 3, Class 4</td>
</tr>
<tr>
<td>ASTM B348</td>
<td>Gr.1, Gr.2, Gr.3, Gr.4, Gr.5</td>
</tr>
<tr>
<td>ASTM F136, AMS492B</td>
<td>Super-TIX™800, Super-TIX™51AF, Super-TIX™523AF, SSAT™-2041CF</td>
</tr>
</tbody>
</table>

(All these materials are available in wire rods and bars. Please consult us for any other sizes or materials.)

### Surface finishes

- **Wire rods**: SF (Super Finish), SF + Annealing, SF + Annealing + Pickling (Special peeling finish).
- **Bars**: Peeling, Pickling (Please consult us for any other surface finish.)

### Available sizes

- **Wire rods**: φ6.0, φ6.5, φ7.0, φ7.5, φ9.5, φ12.0, φ15.0, φ15.5 (mm)
- **Bars**: φ6~φ350 (mm) (Please consult us for any other product size.)

---

Examples of Applications of Titanium

**Electric Power, Energy and Seawater Desalination**

- Ordinary thermal power generation (using LNG)
- Seawater Desalination Plant (MSF)

**Ras Az Zawr Phase-1 Package “D”**

Principle of operation of multi-stage flash (MSF) distillation process
Examples of Applications of Titanium

Chemical Plants and Electrolysis

Conceptual diagram of electrolytic tank with ion exchange membrane

General view of soda electrolytic tank

Multi-tube heat exchanger for chemical use

General view of wet-type Nickel Refining Plant

Conceptual diagram of Nickel Refining Plant

PHE, Aircraft and Jet Engines

PHE equipment

PHE plate

Airbus A380

Jet engine, example
Examples of Applications of Titanium

Automobiles, Consumer Appliances, Sports and Medical Care

- Amuse GT-R and its exhaust system
- YAMAHA YZF-R1
- CASIO OCEANUS
- DUNLOP XX07
- SNOWPEAK tableware made of titanium
- Artificial bone made of titanium
- Titanium flame of glasses

Civil Engineering and Architectural Materials

- Main hall of Kinryuzan Sensoji Temple
- Kyushu National Museum
- Grand National Theater in Beijing, China
- Grand Theater in Hangzhou
- Marques de Riscal Winery Hotel
- Tokyo International Airport D-runway pier
# Standards of Titanium Products [Commercially-Pure Titanium/Corrosion-Resistant Titanium Alloys]

<table>
<thead>
<tr>
<th>Classification</th>
<th>Standard</th>
<th>C</th>
<th>H</th>
<th>O</th>
<th>N</th>
<th>Fe</th>
<th>Pd</th>
<th>Co</th>
<th>Ru</th>
<th>Ni</th>
<th>Ti</th>
<th>0.2% proof stress (MPa)</th>
<th>Tensile strength (MPa)</th>
<th>Elongation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-formable grade</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.15</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>≧120</td>
<td>≧250</td>
<td>≧40</td>
</tr>
<tr>
<td>JIS Class 1</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.15</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>≧165</td>
<td>270–410</td>
<td>≧27</td>
</tr>
<tr>
<td>JIS Class 2</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.20</td>
<td>≦0.03</td>
<td>≦0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>≧215</td>
<td>340–510</td>
<td>≧23</td>
</tr>
<tr>
<td>JIS Class 3</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.30</td>
<td>≦0.05</td>
<td>≦0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>≧235</td>
<td>480–620</td>
<td>≧18</td>
</tr>
<tr>
<td>JIS Class 4</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.40</td>
<td>≦0.05</td>
<td>≦0.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>≧485</td>
<td>550–750</td>
<td>≧15</td>
</tr>
<tr>
<td>ASTM/ASME Grade1</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.18</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>138–310</td>
<td>240</td>
<td>≧24</td>
</tr>
<tr>
<td>ASTM/ASME Grade2</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.25</td>
<td>≦0.03</td>
<td>≦0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>275–450</td>
<td>345</td>
<td>≧20</td>
</tr>
<tr>
<td>ASTM/ASME Grade3</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.35</td>
<td>≦0.05</td>
<td>≦0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>380–550</td>
<td>450</td>
<td>≧18</td>
</tr>
<tr>
<td>ASTM/ASME Grade4</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.40</td>
<td>≦0.05</td>
<td>≦0.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>483–655</td>
<td>550</td>
<td>≧15</td>
</tr>
<tr>
<td>JIS Class 17</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.18</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td>0.04–0.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>170</td>
<td>240–380</td>
<td>≧24</td>
</tr>
<tr>
<td>JIS Class 19</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.25</td>
<td>≦0.03</td>
<td>≦0.30</td>
<td>0.04–0.08 0.20–0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>275</td>
<td>345–515</td>
<td>≧20</td>
</tr>
<tr>
<td>JIS Class 20</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.35</td>
<td>≦0.05</td>
<td>≦0.30</td>
<td>0.04–0.08 0.20–0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>380</td>
<td>450–590</td>
<td>≧18</td>
</tr>
<tr>
<td>ASTM/ASME Gr.17</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.18</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td>0.04–0.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>138–310</td>
<td>240</td>
<td>≧24</td>
</tr>
<tr>
<td>ASTM/ASME Gr.30</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.25</td>
<td>≦0.03</td>
<td>≦0.30</td>
<td>0.04–0.08 0.20–0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>275–450</td>
<td>345</td>
<td>≧20</td>
</tr>
<tr>
<td>ASTM/ASME Gr.31</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.35</td>
<td>≦0.05</td>
<td>≦0.30</td>
<td>0.04–0.08 0.20–0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>380–550</td>
<td>450</td>
<td>≧18</td>
</tr>
<tr>
<td>JIS Class 11</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.15</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td>0.12–0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>165</td>
<td>270–410</td>
<td>≧27</td>
</tr>
<tr>
<td>JIS Class 12</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.20</td>
<td>≦0.03</td>
<td>≦0.25</td>
<td>0.12–0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>215</td>
<td>340–510</td>
<td>≧23</td>
</tr>
<tr>
<td>JIS Class 13</td>
<td>≦0.08</td>
<td>≦0.013</td>
<td>≦0.30</td>
<td>≦0.05</td>
<td>≦0.30</td>
<td>0.12–0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>235</td>
<td>480–620</td>
<td>≧18</td>
</tr>
<tr>
<td>ASTM/ASME Grade11</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.18</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td>0.12–0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>138–310</td>
<td>240</td>
<td>≧24</td>
</tr>
<tr>
<td>ASTM/ASME Grade7</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.25</td>
<td>≦0.03</td>
<td>≦0.30</td>
<td>0.12–0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>275–450</td>
<td>345</td>
<td>≧20</td>
</tr>
<tr>
<td>JIS Class 21</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.10</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td>0.04–0.06 0.40–0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>170</td>
<td>275–450</td>
<td>≧24</td>
</tr>
<tr>
<td>JIS Class 22</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.15</td>
<td>≦0.03</td>
<td>≦0.30</td>
<td>0.04–0.06 0.40–0.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>275</td>
<td>410–530</td>
<td>≧20</td>
</tr>
<tr>
<td>ASTM/ASME Grade13</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.10</td>
<td>≦0.03</td>
<td>≦0.20</td>
<td>0.04–0.06 0.4–0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>170</td>
<td>275</td>
<td>≧24</td>
</tr>
<tr>
<td>ASTM/ASME Grade14</td>
<td>≦0.08</td>
<td>≦0.015</td>
<td>≦0.15</td>
<td>≦0.03</td>
<td>≦0.30</td>
<td>0.04–0.06 0.4–0.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rem.</td>
<td>275</td>
<td>410</td>
<td>≧20</td>
</tr>
</tbody>
</table>
### Standards of Titanium Products [Titanium Alloys]

<table>
<thead>
<tr>
<th>Nominal composition or company standard</th>
<th>Product form</th>
<th>Chemical composition (mass%)</th>
<th>Examples of Tensile properties at room temperature (minimum values)</th>
<th>Advantageous features</th>
<th>Main related standards, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Sheet Welded Tube Bar wire rod</td>
<td>Al V Mo Cr Zr Sn Si Cu Nb Fe O N C</td>
<td>Heat treatment</td>
<td>0.2% proof stress min. (MPa)</td>
<td>Tensile strength min. (MPa)</td>
<td>Elongation min. (%)</td>
</tr>
<tr>
<td>Ti-3AI-2.5V</td>
<td>○○○</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ti-6AI-4V</td>
<td>○○○</td>
<td>5.50-6.75 3.50-4.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ti-6AI-4V ELI</td>
<td>○○○</td>
<td>5.5-6.5 35-45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ti-6AI-6V-2Sn</td>
<td>○○○</td>
<td>5.50-6.50 5.52-6.50 3.60-4.40 1.75-2.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ti-3AI-8V-6Cr-4Mo-4Zr</td>
<td>○○○</td>
<td>3.0-4.0 75-85 35-45 5.5-6.5 3.5-45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ti-10V-2Fe-3Al</td>
<td>○○○</td>
<td>2.6-3.4 90-110</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ti-15V-3Cr-3Sn-3Al</td>
<td>○○○</td>
<td>3.0-3.5 14.0-16.0 2.5-3.5 2.5-3.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™800</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™900</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™903</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™8034</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1025</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1050</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1100</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1225</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1250</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1325</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1450</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1500</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1625</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1750</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super-TiX™1900</td>
<td>○○○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* ST: Solution treatment  STA: Solution treatment + aging

* Please consult us when placing an order.
# Technical Data

## Physical Properties

The advantageous physical properties of pure titanium are as follows.

1. Light weight
2. Low thermal expansion
3. Low electric conductivity
4. Low magnetic permeability
5. Low thermal expansion
6. Non-magnetic

[SUS 304] is [Super-Super-duralumin].

### Comparison of physical properties between titanium and other metallic materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Atomic number</th>
<th>Atomic weight</th>
<th>Specific gravity</th>
<th>Melting point (°C)</th>
<th>Linear expansion coefficient (×10⁻⁶/°C)</th>
<th>Specific heat (J/kg·K)</th>
<th>Thermal conductivity (W/m·K)</th>
<th>Specific resistivity (μΩ·m)</th>
<th>Elastic conductivity (% ratio to copper)</th>
<th>Young’s modulus (GPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium</td>
<td>22</td>
<td>47.90</td>
<td>4.51</td>
<td>1688</td>
<td>8.4×10⁻⁶</td>
<td>0.519</td>
<td>17</td>
<td>0.55</td>
<td>3.1</td>
<td>106.3</td>
</tr>
<tr>
<td>Titanium alloy Ti-6Al-4V</td>
<td>—</td>
<td>—</td>
<td>4.43</td>
<td>1650</td>
<td>8.6×10⁻⁶</td>
<td>0.90</td>
<td>12</td>
<td>0.09</td>
<td>18</td>
<td>205.8</td>
</tr>
<tr>
<td>18-8 stainless steel</td>
<td>26</td>
<td>55.85</td>
<td>7.9</td>
<td>1530</td>
<td>12×10⁻⁶</td>
<td>0.460</td>
<td>63</td>
<td>0.097</td>
<td>18</td>
<td>205.8</td>
</tr>
<tr>
<td>Aluminum</td>
<td>13</td>
<td>26.97</td>
<td>2.7</td>
<td>650</td>
<td>23×10⁻⁶</td>
<td>0.879</td>
<td>205</td>
<td>0.027</td>
<td>64</td>
<td>69.1</td>
</tr>
<tr>
<td>Aluminum alloy (7075)</td>
<td>—</td>
<td>—</td>
<td>2.8</td>
<td>1400 ~1420</td>
<td>17×10⁻⁶</td>
<td>0.502</td>
<td>16</td>
<td>0.72</td>
<td>2.4</td>
<td>199.9</td>
</tr>
<tr>
<td>Magnesium</td>
<td>12</td>
<td>24.32</td>
<td>1.7</td>
<td>650</td>
<td>25×10⁻⁶</td>
<td>1.004</td>
<td>159</td>
<td>0.043</td>
<td>40</td>
<td>44.8</td>
</tr>
<tr>
<td>Nickel</td>
<td>26</td>
<td>58.69</td>
<td>8.9</td>
<td>1453</td>
<td>15×10⁻⁶</td>
<td>0.460</td>
<td>92</td>
<td>0.095</td>
<td>18</td>
<td>205.8</td>
</tr>
<tr>
<td>Hastelloy C</td>
<td>—</td>
<td>8.9</td>
<td>1.3</td>
<td>1083</td>
<td>11.3×10⁻⁶</td>
<td>0.385</td>
<td>13</td>
<td>1.3</td>
<td>1.3</td>
<td>204.4</td>
</tr>
<tr>
<td>Copper</td>
<td>29</td>
<td>63.57</td>
<td>8.9</td>
<td>1083</td>
<td>17×10⁻⁶</td>
<td>0.385</td>
<td>385</td>
<td>0.017</td>
<td>100</td>
<td>107.8</td>
</tr>
</tbody>
</table>

### Comparison of corrosion resistance between titanium and other metallic materials

<table>
<thead>
<tr>
<th>Corroding medium</th>
<th>Composition (%)</th>
<th>Temperature (°C)</th>
<th>Corrosion resistance</th>
<th>Hastelloy C</th>
<th>Titanium</th>
<th>Stainless steel (18-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>10</td>
<td>24</td>
<td>X</td>
<td>◎</td>
<td>○</td>
<td>◎</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10</td>
<td>50</td>
<td>◎</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>10</td>
<td>24</td>
<td>X</td>
<td>◎</td>
<td>○</td>
<td>◎</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10</td>
<td>50</td>
<td>◎</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>10</td>
<td>24</td>
<td>X</td>
<td>◎</td>
<td>○</td>
<td>◎</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10</td>
<td>50</td>
<td>◎</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>10</td>
<td>24</td>
<td>X</td>
<td>◎</td>
<td>○</td>
<td>◎</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10</td>
<td>50</td>
<td>◎</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>10</td>
<td>24</td>
<td>X</td>
<td>◎</td>
<td>○</td>
<td>◎</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10</td>
<td>50</td>
<td>◎</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>10</td>
<td>24</td>
<td>X</td>
<td>◎</td>
<td>○</td>
<td>◎</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10</td>
<td>50</td>
<td>◎</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>10</td>
<td>24</td>
<td>X</td>
<td>◎</td>
<td>○</td>
<td>◎</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>10</td>
<td>50</td>
<td>◎</td>
<td>×</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### Corrosion Resistance

<table>
<thead>
<tr>
<th>Corroding medium</th>
<th>Temperature (°C)</th>
<th>Corrosion resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>50</td>
<td>◎</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>50</td>
<td>◎</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>50</td>
<td>◎</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>50</td>
<td>◎</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>50</td>
<td>◎</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>50</td>
<td>◎</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>24</td>
<td>X</td>
</tr>
<tr>
<td>Sulfuric acid</td>
<td>50</td>
<td>◎</td>
</tr>
</tbody>
</table>

### Note
- 18-8 stainless steel:
  - 0.508~1.27 (Source: Japan Titanium Society)
- Other local corrosion occurs with the material.
- Corrosion rate: ○ < 0.127, × > 1.27 (Source: Japan Titanium Society)
Corrosion Resistance in Seawater

Influences of temperature, concentration and pH on pitting/crevice corrosion of commercially pure titanium in salty water

Orders of Stabilization of Metals

Clarke Number (Note)

Tensile Properties in High Temperature