I. Overview of GH3536 (HastelloyX) nickel-based superalloy:
GH3536 is a nickel-based high-temperature alloy with high iron content and good hot workability and weldability, which is mainly strengthened by solid solution of chromium and molybdenum. It can be used to manufacture the combustion chamber parts and other high-temperature parts of aero engines. It can be used for a long time below 900 ° C and the short-term working temperature can reach 1080 ° C. We can supply in form of plate, strip, pipe, bar, forging, ring and precision casting.

1. Chinese Grade: GH3536 (GH536, GH22, GH334, GH739, SG-5)
2. Similar grades: UNS NO6002, HastelloyX (USA), NiCr22FeMo (Germany), Nimonic PE13 (UK).
3. Technical standards compliance: ASTM.
4. Chemical composition: see table 1-1:

<table>
<thead>
<tr>
<th>%</th>
<th>C≤</th>
<th>Si≤</th>
<th>Mn≤</th>
<th>P≤</th>
<th>S≤</th>
<th>Cr≥</th>
<th>Ni≥</th>
<th>Mo≥</th>
<th>Cu≤</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05-0.15</td>
<td>1</td>
<td>0.025</td>
<td>0.015</td>
<td>20.5-23.5</td>
<td>Balance</td>
<td>8.0-10.0</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Miscellaneous</th>
<th>N≤</th>
<th>Al≤</th>
<th>Ti≤</th>
<th>Fe≤</th>
<th>Co≤</th>
<th>V≤</th>
<th>W≤</th>
<th>B≤</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.15</td>
<td>0.15</td>
<td>0.17</td>
<td>0.20-0.25</td>
<td>-</td>
<td>0.20-1.00</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

Note: B is added according to the calculation amount, without analysis

5. Heat treatment system: plate and pipe: 1130 ~ 1170 °C, fast air cooling or water cooling; bar and ring test sample: 1175 °C ± 15 °C, air cooling or faster cooling; strip: 1065 ~ 1105 °C, fast cooling.

6. Variety specifications and Ex-factory status: supply plates of δ 0.5 ~ 4.0mm, strips of 0.05 ~ 0.8mm, pipes with an outer diameter of 4-20mm, wall thickness of 1.0 ~ 2.0mm, welding wires with a diameter of 0.2 ~ 10.0mm, Rods with a diameter of ≤300mm, ring pieces of various diameters and wall thicknesses, and precision castings of different shapes and sizes. Sheets, strips and pipes are supplied after solution treatment and pickling, and strips can also be supplied in cold rolled state; welding wire is delivered in hard, semi-rigid, solid solution plus pickling, bright solution treatment, Can also be delivered straight; bars and rings are delivered without heat treatment. Precision castings are supplied in the as-cast condition.

7. Smelting and casting process: using electric arc furnace plus electroslag or non-vacuum induction furnace plus electroslag remelting process. In the production of castings, an induction furnace is used to remelt the master alloy and then it is poured into a heated mold shell. The pouring speed is better.
8. Application overview and special requirements: This alloy has been widely used in aerospace engines and civil industries abroad. Our country is mainly used to manufacture combustion chamber components and other hot-end components and honeycomb structures. The alloy has certain aging hardening phenomenon after long-term use at high temperature.

II. Physical and chemical properties:

1. Melting temperature range: 1295 ~ 1381 °C [1].

2. Thermal conductivity: see Table 2-1.

3. Specific heat capacity: See Table 2-2.

4. Density: \( \rho = 8.3 \text{g/cm}^3 \)

Table 2-1

<table>
<thead>
<tr>
<th>( \theta )/ °C</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \lambda )/((\text{W/}(\text{m}\cdot\text{°C})))</td>
<td>13.38</td>
<td>17.97</td>
<td>20.27</td>
<td>22.4</td>
<td>24.62</td>
<td>26.79</td>
<td>29.05</td>
<td>31.14</td>
<td>33.44</td>
</tr>
</tbody>
</table>

Table 2-2

<table>
<thead>
<tr>
<th>( \theta )/ °C</th>
<th>17</th>
<th>100</th>
<th>200</th>
<th>280</th>
<th>408</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>( c/((\text{J/}\text{kg}\cdot\text{°C})))</td>
<td>372.6</td>
<td>372.6</td>
<td>389.4</td>
<td>456.4</td>
<td>427.1</td>
<td>452.2</td>
<td>464.7</td>
<td>515</td>
<td>535.9</td>
<td>561</td>
</tr>
</tbody>
</table>

III. Characteristics:

1. Easy to machine.
2. Medium-duration and creep resistance at 900 °C.
3. It has good oxidation resistance and corrosion resistance.
4. Suitable for aero-engine combustion chamber and afterburner components for long-term use below 900 °C.
5. Good welding performance.

IV. Application fields:

1. Industrial and aviation turbine components.
2. Industrial furnace components, support rollers, grids, ribbons and radiant tubes.
3. Spiral tube in petrochemical furnace.
4. High temperature gas cools the nuclear reactor.

V. Process performance and requirements:

1. The solution treatment temperature range is from 1160 °C to 1190 °C, preferably around 1175 °C. For maximum creep strength, water quenching is recommended for cooling. For materials less than 1.5mm thick, rapid air cooling can also be used. The stress relief annealing temperature is up to 870 °C. During the heat treatment, the workpiece must be kept clean.
2. The adhesion between the surface oxide of the deoxidized scale and the welding slag around the weld is stronger than that of stainless steel. It is recommended to use fine-grained abrasive belts or fine-grained wheels for grinding.

3. Before pickling with HNO₃ / HF mixed acid, the oxide film must be blasted or sanded to break the oxide film.

4. Machining: Machining should be performed in the solution treatment state. Because Nicrofer 4722 Co has higher work hardening, it is advisable to use a low cutting speed and a heavy-feed cutter to work under the surface that has been cold-work hardened.

5. Welding: Welding can be performed by various welding processes, such as tungsten electrode inert gas shielded welding, plasma arc welding, manual sub-arc welding, metal extremely inert gas shielded welding, and molten extremely inert gas shielded welding. Preference is given to pulsed arc welding. Before welding, the material must be in the solution treatment state to remove oxide scale, oil stains and various mark marks. The width of each side of the weld is about 25mm, and it needs to be polished to a bright metal surface. With low heat input, the inter-layer temperature does not exceed 100 °C.

6. No heat treatment before and after welding is required.

VI. Specifications and Ex-factory status:

1. Classification: Huacheng Jinyan can supply in form of seamless pipes, steel plates, round steel, forgings, flanges, rings, welded pipes, steel strips, wire and supporting welding materials.

2. Ex-factory status: Seamless Tube: solid solution + acid white, length can be fixed; Plate: solid solution, pickling, trimming; Welded Tube: solid solution acid white + RT% flaw detection; Forging: annealing + turning; the bar is delivered in the state of forging, surface polishing or lapping; the strip is delivered after cold rolling, solid solution softening, and descaling; the wire is solid-dissolved and pickled in a disc or straight strip, solid solution straight polished.