Disclosed are a highly corrosion-resistant aluminum alloy for a heat exchanger tube and a method for manufacturing a heat exchanger tube using the same. The highly corrosion-resistant aluminum alloy includes 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.6 to 1.2 wt % of manganese, 0.15 to 0.45 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities. The aluminum alloy aluminum alloy for a heat exchanger tube improves corrosion resistance without affecting the physical properties other than corrosion resistance, through improvement in composition of the alloy, and ensures sufficient corrosion resistance without thermal arc spraying of zinc, resulting in a simple process, which leads to improvement in manufacturing efficiency and productivity of products.
FIG. 1

S100
CONTINUOUS CASTING/CONTINUOUS PROPERZI

S200
THERMAL TREATMENT

S300
DIRECT EXTRUSION/CONFORM EXTRUSION
HIGHLY CORROSION-RESISTANT ALUMINUM ALLOY FOR HEAT EXCHANGER TUBE AND METHOD FOR MANUFACTURING HEAT EXCHANGER TUBE USING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Korean Patent Application No. 10-2009-0129087 filed in Republic of Korea on Dec. 22, 2009, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention
[0003] The present invention relates to a highly corrosion-resistant aluminum alloy for a heat exchanger tube and a method for manufacturing a heat exchanger tube using the same, and more particularly, to an aluminum alloy which may provide good corrosion resistance suitable for a heat exchanger tube by improving composition of the aluminum alloy, and a method for manufacturing a heat exchanger tube using the same.
[0004] 2. Description of the Related Art
[0005] A heat exchanger tube is one of components used in an automobile heat exchanger, and is made from an aluminum alloy in consideration of light weight, high strength and thermal conductivity characteristics. The heat exchanger tube is mounted in a heat exchanger of transportation vehicles including automobiles, and ensures a high heat transfer efficiency, resulting in reduced fuel consumption of the transportation vehicles.
[0006] The heat exchanger tube is used to vehicles, particularly, to a radiator, a heater core and an oil cooler, where a cooling water is used as a coolant, and to a condenser, an evaporator, and the like, where R134a is used as a coolant, according to purpose of usage. The heat exchanger tube is directly contacted with a coolant, and thus, it needs to be made from an aluminum alloy having excellent strength, extrudability and corrosion resistance.
[0007] Japanese Patent Publication No. 11-21649 (hereinafter referred to as a ‘Patent Document 1’) suggests an aluminum alloy comprising 0.15 to 0.35 wt % of iron, 0.15 wt % or less of silicon, less than 0.03 wt % of zinc, 0.35 to 0.55 wt % of copper, 0.02 to 0.05 wt % of zirconium, 0.003 to 0.01 wt % of titanium, and the remainder of aluminum and inevitable impurities, wherein Fe/Si≤2.5.
[0008] The aluminum alloy set forth in the Patent Document 1 uses copper and zinc to ensure corrosion resistance of the alloy, however because a large amount of copper is used, a large amount of Al—Cu intermetallic compound is produced, resulting in deterioration in extrusion characteristic, reduction in a corrosion potential of a base material, and deterioration in corrosion resistance characteristic. And, hot cracking and stress corrosion cracking may occur during zinc casting, resulting in deterioration in manufacturing characteristics and quality of products.

SUMMARY OF THE INVENTION

[0009] The present invention is designed to solve the problem, and it is an object of the present invention to provide an aluminum alloy for a heat exchanger tube which may provide excellent extrusion characteristic and high corrosion resistance in various corrosive environments by improving composition of the aluminum alloy, and a method for manufacturing a heat exchanger tube using the same.
[0010] To achieve the object, the present invention according to an aspect discloses a highly corrosion-resistant aluminum alloy for a heat exchanger tube including 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.6 to 1.2 wt % of manganese, 0.15 to 0.45 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and inevitable impurities.
[0011] According to another aspect, the present invention discloses a highly corrosion-resistant aluminum alloy for a heat exchanger tube including 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.3 to 0.7 wt % of manganese, 0.3 to 0.7 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities.
[0012] Preferably, the content of iron may be 0.05 to 0.3 wt %.
[0013] Preferably, the content of zirconium or boron may be 0.05 to 0.2 wt %.
[0014] According to still another aspect, the present invention discloses a method for manufacturing a heat exchanger tube including thermally treating a billet or a wire rod at a temperature range between 450 and 650°C. for 10 to 25 hours, the billet or the wire rod being made from an aluminum alloy including 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.6 to 1.2 wt % of manganese, 0.15 to 0.45 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities, and performing a direct extrusion or a conform extrusion on the billet or the wire rod to manufacture a heat exchanger tube.
[0015] According to yet another aspect, the present invention discloses a method for manufacturing a heat exchanger tube including thermally treating a billet or a wire rod at a temperature range between 450 and 650°C. for 10 to 25 hours, the billet or the wire rod being made from an aluminum alloy comprising 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.3 to 0.7 wt % of manganese, 0.3 to 0.7 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities, and performing a direct extrusion or a conform extrusion on the billet or the wire rod to manufacture a heat exchanger tube.
[0016] In the present invention, an alloy molten metal is poured at a temperature range between 750 and 900°C. to produce the billet by continuous casting, or to produce the wire rod by continuous casting and rolling (properzi).
[0017] In the present invention, the method may further include performing thermal arc spraying (TAS) on the surface of the heat exchanger tube.
[0018] Preferably, the heat exchanger tube may have a controlled crystal grain size of 50 μm or less after the direct extrusion or the conform extrusion, and a controlled crystal grain size of 70 μm or less after the brazing-thermal treatment.

EFFECTS OF THE PRESENT INVENTION

[0019] According to the present invention, an aluminum alloy for a heat exchanger tube may improve corrosion resistance without affecting the physical properties other than corrosion resistance, through improvement in composition of the aluminum alloy, and may ensure sufficient corrosion resistance without thermal arc spraying of zinc, resulting in a
simple process, which may lead to improvement in manufacturing efficiency and productivity of products.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0020] The accompanying drawings illustrate the preferred embodiments of the present invention and are included to provide a further understanding of the spirit of the present invention together with the detailed description of the invention, and accordingly, the present invention should not be limitedly interpreted to the matters shown in the drawings.

[0021] FIG. 1 is a flowchart illustrating a method for manufacturing a heat exchanger tube according to the present invention.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

[0022] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. Prior to the description, it should be understood that the terms used in the specification and the appended claims should not be construed as limited to general and dictionary meanings, but interpreted based on the meanings and concepts corresponding to technical aspects of the present invention based on the principle that the inventor is allowed to define terms appropriately for the best explanation. Therefore, the description proposed herein is just a preferable example for the purpose of illustrations only, not intended to limit the scope of the invention, so it should be understood that other equivalents and modifications could be made thereto without departing from the spirit and scope of the invention.

[0023] A highly corrosion-resistant aluminum alloy for a heat exchanger tube according to the present invention includes 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.6 to 1.2 wt % of manganese, 0.15 to 0.45 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and inevitable impurities.

[0024] Iron is a transition metal with an atomic symbol of Fe, an atomic number of 26, a standard atomic weight of 55.847, a specific gravity of 7.86, a melting point of 1540°C, and a boiling point of 2750°C. Iron is present as an Al—Fe intermetallic compound in a matrix. When iron coexists with manganese or with manganese and silicon, an Al—Mn—Fe intermetallic compound or Al—Mn—Fe—Si intermetallic compound is formed after crystallization, which improves in strength after brazing and suppresses grain coarsening.

[0025] In the present invention, the content of iron is preferably 0.05 to 0.3 wt % per the total weight of the aluminum alloy. When the content of iron is less than 0.05 wt %, it is not preferred because it is difficult to obtain effects anticipated from addition of iron, for example, strength improvement, and the like. When the content of iron exceeds 0.3 wt %, it is not preferred because extrudability and corrosion resistance are reduced at the same time.

[0026] Silicon is a non-metallic element with an atomic symbol of Si, an atomic number of 14, a standard atomic weight of 28.086, a specific gravity of 2.32, a melting point of 1410°C, and a boiling point of 2335°C, and silicon contributes to improvement in extrudability by reducing a deformation resistance at an extrusion temperature. When silicon coexists with iron, an Al—Fe—Si intermetallic compound is formed after crystallization, which suppresses grain growth by inhibiting grain boundary migration during brazing.

[0027] In the present invention, the content of silicon is preferably 0.05 to 0.2 wt % per the total weight of the aluminum alloy. When the content of silicon is less than 0.05 wt %, it is not preferred because an increase in a manufacturing cost is inevitable to ensure high quality of a base material, that is, an ingot during casting. When the content of silicon exceeds 0.2 wt %, it is not preferred because extrudability decreases due to increased strength of the alloy.

[0028] Manganese is a transition metal with an atomic symbol of Mn, an atomic number of 25, a standard atomic weight of 54.9381, a specific gravity between 7.2 and 7.45, a melting point of 1244°C and a boiling point of 1962°C. After crystallization, manganese exists as a fine-grained Al—Mn intermetallic compound, which contributes to improvement in strength after brazing by enabling a corrosion potential of the aluminum alloy to become noble. When manganese coexists with silicon, an Al—Mn—Si intermetallic compound is formed after crystallization, which improves the strength after brazing. Accordingly, manganese increases a potential difference between a heat exchanger tube and a tube fin by controlling a corrosion potential of the heat exchanger tube to become noble, thereby promoting a corrosion resistant effect of the fin more effectively and improving external corrosion resistance.

[0029] In the present invention, the content of manganese is preferably 0.6 to 1.2 wt % per the total weight of the aluminum alloy. When the content of manganese is less than 0.6 wt %, it is not preferred because it is difficult to obtain effects anticipated from addition of manganese, for example, improvement in corrosion resistance, and the like. When the content of manganese exceeds 1.2 wt %, it is not preferred because extrudability is reduced.

[0030] Copper is a transition metal with an atomic symbol of Cu, an atomic number of 29, a standard atomic weight of 63.546, a specific gravity of 8.92, a melting point of 1084.5°C and a boiling point of 2595°C, and copper is solidified within a matrix to improve the strength after brazing. Also, copper contributes to improvement in corrosion resistance by controlling a corrosion potential of a heat exchanger tube to become noble.

[0031] In the present invention, the content of copper is preferably 0.15 to 0.45 wt % per the total weight of the aluminum alloy. When the content of copper is less than 0.15 wt %, it is not preferred because it is difficult to obtain effects anticipated from addition of copper, for example, improvement in corrosion resistance, and the like. When the content of copper exceeds 0.45 wt %, it is not preferred because extrudability and corrosion resistance are reduced at the same time.

[0032] Alternatively, the content of manganese may be adjusted between 0.3 and 0.7 wt % per the total weight of the aluminum alloy. In this case, to compensate for the reduced content of manganese, it is preferred to adjust the content of copper between 0.3 and 0.7 wt %. When the content of manganese is high, cracking may occur during continuous casting and rolling (properzi), resulting in deterioration of workability of continuous casting and rolling (properzi). For this reason, the content of manganese is decreased so as to improve workability of continuous casting and rolling (properzi). Reduction in corrosion resistance caused by the reduced manganese content may be compensated through control of the copper content in an Al—Mn—Cu intermetallic compound that will be formed after crystallization.
Zirconium is a transition metal with an atomic symbol of Zr, an atomic number of 40, a standard atomic weight of 91.22, a specific gravity of 6.51, a melting point of 1852°C, and a boiling point of 3578°C. Boron is a non-metallic element with an atomic symbol of B, an atomic number of 5, a standard atomic weight of 10.811, a specific gravity of 1.73 (amorphous), a melting point of 2300°C, and a boiling point of 2550°C. When zirconium and boron are used in the aluminum alloy, they have similar effects. Accordingly, either zirconium or boron, or both is used. Zirconium and boron contribute to improvement in extrusion characteristics by reducing deformation resistance during extrusion, and improvement in strength by suppressing grain coarsening after brazing.

In the present invention, the content of zirconium or boron is preferably between 0.05 and 0.2 wt % per the total weight of the aluminum alloy. When the content of zirconium or boron is less than 0.05 wt %, it is not preferred because it is difficult to obtain effects anticipated from addition of zirconium or boron, for example, improvement in strength, and the like. When the content of zirconium or boron exceeds 0.2 wt %, it is not preferred because costs increase due to an additional content of zirconium or boron, and effects anticipated from further addition of zirconium or boron, that is, improvement in extrudability and moldability is insignificant.

Hereinafter, a method for manufacturing the heat exchanger tube according to the present invention is described with reference to FIG. 1.

FIG. 1 is a flowchart illustrating a method for manufacturing a heat exchanger tube according to the present invention.

Referring to FIG. 1, a method for manufacturing a heat exchanger tube according to the present invention includes pouring an aluminum alloy in the state of a molten metal at a temperature range between 750° C. and 900° C., and producing a billet or a wire rod by continuous casting or by continuous casting and rolling (properz) respectively, in the step S100, wherein the aluminum alloy includes 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.6 to 1.2 wt % of manganese, 0.15 to 0.45 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and inevitable impurities. In this instance, the wire rod has a diameter between 8.0 and 15 mmφ.

According to the present invention, in the composition of the aluminum alloy, the content of iron may be 0.05 to 0.3 wt %, and the content of zirconium or boron may be 0.05 to 0.2 wt %. Alternatively, the content of manganese may be adjusted between 0.3 and 0.7 wt %. In this case, it is preferred to adjust the copper content between 0.3 and 0.7 wt % so as to compensate for the reduced content of manganese.

According to the present invention, the pouring temperature range of the molten metal is selected to obtain a solid of an intermetallic compound, that is, a cast product with an elaborate microstructure. When the pouring temperature of the molten metal exceeds 900° C., grain coarsening occurs in the microstructure of the cast product, and when the pouring temperature of the molten metal is less than 750° C., a ‘miss run’ phenomenon occurs, in which a casting space is not densely filled with the molten metal due to poor flowability of the molten metal. Accordingly, an optimum pouring temperature range is between 750 and 900° C.

The billet or wire rod is thermally treated at a temperature range between 450 and 650°C for 10 to 25 hours, in the step S200.

The thermally treated billet or wire rod is extruded by a direct extrusion or a conform extrusion to manufacture a heat exchanger tube, in the step S300. In this instance, the billet is pre-heated at a temperature range between 300 and 500° C., and then is extruded at an extrusion temperature range between 300 and 500° C.

According to the present invention, the manufactured heat exchanger tube has a controlled crystal grain size of 50 μm or less, particularly a controlled crystal grain size after brazing-thermal treatment of 70 μm or less, to provide a fine crystalline structure free of coarse grains, resulting in improved corrosion resistance.

To prepare for extreme corrosion resistance, thermal arc spraying (TAS) of zinc for providing a sacrificial cathode effect may be made on the surface of the heat exchanger tube.

Hereinafter, the present invention is described in detail through examples 1 to 5 and comparative examples 1 to 7 for ease of understanding of the present invention. However, the description proposed herein is just a preferable example for the purpose of illustrations only, not intended to limit the scope of the invention.

Aluminum alloys of examples 1 to 5 according to the present invention and comparative examples 1 to 7 were prepared. The component analysis results of these aluminum alloys are summarized in Table 1 to show compositions of the aluminum alloys. The compositions of the aluminum alloys are indicated by weight %, and it is taken into consideration that each aluminum alloy may contain inevitable impurities.

<table>
<thead>
<tr>
<th>Example</th>
<th>Fe (wt %)</th>
<th>Cu (wt %)</th>
<th>Mn (wt %)</th>
<th>Si (wt %)</th>
<th>Zr (wt %)</th>
<th>B (wt %)</th>
<th>Ti (wt %)</th>
<th>Al (wt %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example 1</td>
<td>0.15</td>
<td>0.45</td>
<td>0.60</td>
<td>0.1</td>
<td>0.20</td>
<td>—</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Example 2</td>
<td>0.42</td>
<td>0.39</td>
<td>0.07</td>
<td>0.1</td>
<td>0.20</td>
<td>0.09</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Example 3</td>
<td>0.45</td>
<td>0.35</td>
<td>0.11</td>
<td>0.1</td>
<td>0.15</td>
<td>0.08</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Example 4</td>
<td>0.15</td>
<td>0.42</td>
<td>0.70</td>
<td>0.1</td>
<td>0.20</td>
<td>—</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Example 5</td>
<td>0.28</td>
<td>0.40</td>
<td>0.40</td>
<td>0.1</td>
<td>0.15</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Comparative example 1</td>
<td>0.10</td>
<td>0.12</td>
<td>0.05</td>
<td>0.06</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Comparative example 2</td>
<td>0.22</td>
<td>0.40</td>
<td>—</td>
<td>0.07</td>
<td>0.04</td>
<td>0.008</td>
<td>Bal.</td>
<td></td>
</tr>
<tr>
<td>Comparative example 3</td>
<td>0.15</td>
<td>0.07</td>
<td>0.13</td>
<td>0.08</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Comparative example 4</td>
<td>0.17</td>
<td>0.41</td>
<td>0.14</td>
<td>0.08</td>
<td>0.03</td>
<td>—</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Comparative example 5</td>
<td>0.02</td>
<td>0.5</td>
<td>0.9</td>
<td>0.1</td>
<td>0.13</td>
<td>—</td>
<td>—</td>
<td>Bal.</td>
</tr>
<tr>
<td>Comparative example 6</td>
<td>0.02</td>
<td>0.1</td>
<td>1.2</td>
<td>0.1</td>
<td>0.13</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Comparative example 7</td>
<td>0.13</td>
<td>0.09</td>
<td>0.50</td>
<td>0.1</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Bal.</td>
</tr>
</tbody>
</table>

Heat exchanger tubes were manufactured using the aluminum alloys of examples 1 to 5 and comparative examples 1 to 7 by pouring an alloy in the state of a molten metal at a controlled temperature range between 750 and 900°C, and casting the molten metal in the form of a wire rod through continuous casting and rolling (properz), followed by thermal treatment and a conform extrusion.

A SWAAT test was made according to the ASTM standards in order to evaluate corrosion resistant characteristics of the manufactured heat exchanger tubes, and the test results are shown in Table 2. In this instance, the heat exchanger tubes used were all gone through brazing simulations (600° C.×10 min) before the SWAAT testing.
The SWAAT testing is based on ASTM G85 standard, and is carried out by adding glacial acetic acid to 4.2 wt % NaCl solution, and spraying under an atmosphere of 49°C and 0.07 Mpa while maintaining pH between 2.8 and 3.0. A spraying amount was maintained between 1 and 2 ml/hr.

As seen in Table 2, when compared with comparative examples 1 to 7, examples 1 to 5 have better extrudability and better corrosion resistant characteristics without thermal spraying of zinc for providing a sacrificial cathode effect. Accordingly, a heat exchanger tube manufactured using an aluminum alloy according to the present invention is usable for a long time even in different corrosion environments, without pitting.

Hereinabove, the present invention is described with reference to the limited embodiments and drawings. However, the description proposed herein is just a preferable example for the purpose of illustrations only, not intended to limit the scope of the invention, so it should be understood that other equivalents and modifications could be made thereto without departing from the spirit and scope of the invention.

What is claimed is:

1. A highly corrosion-resistant aluminum alloy for a heat exchanger tube, comprising:
   - 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.6 to 1.2 wt % of manganese, 0.15 to 0.45 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities.

2. The highly corrosion-resistant aluminum alloy for a heat exchanger tube according to claim 1, wherein the content of iron is 0.05 to 0.3 wt %.

3. The highly corrosion-resistant aluminum alloy for a heat exchanger tube according to claim 2, wherein the content of zirconium or boron is 0.05 to 0.2 wt %.

4. A highly corrosion-resistant aluminum alloy for a heat exchanger tube, comprising:
   - 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.3 to 0.7 wt % of manganese, 0.3 to 0.7 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities.

5. The highly corrosion-resistant aluminum alloy for a heat exchanger tube according to claim 4, wherein the content of iron is 0.05 to 0.3 wt %.

6. The highly corrosion-resistant aluminum alloy for a heat exchanger tube according to claim 5, wherein the content of zirconium or boron is 0.05 to 0.2 wt %.

7. A method for manufacturing a heat exchanger tube, comprising:
   - thermally treating a billet or a wire rod at a temperature range between 450 and 650°C. For 10 to 25 hours, the billet or the wire rod being made from an aluminum alloy comprising 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.6 to 1.2 wt % of manganese, 0.15 to 0.45 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities; and
   - performing a direct extrusion or a conform extrusion on the billet or the wire rod to manufacture a heat exchanger tube.

8. The method for manufacturing a heat exchanger tube according to claim 7, wherein the content of iron is 0.05 to 0.3 wt %.

9. The method for manufacturing a heat exchanger tube according to claim 8, wherein the content of zirconium or boron is 0.05 to 0.2 wt %.

10. The method for manufacturing a heat exchanger tube according to claim 9, wherein an alloy molten metal is poured at a temperature range between 750 and 900°C to produce the billet by continuous casting or to produce the wire rod by continuous casting and rolling (properzi).

11. The method for manufacturing a heat exchanger tube according to claim 10, further comprising:
   - performing thermal arc spraying (TAS) on the surface of the heat exchanger tube.

12. The method for manufacturing a heat exchanger tube according to claim 11, wherein the heat exchanger tube has a controlled crystal grain size of 50 µm or less after the direct extrusion or the conform extrusion and a controlled crystal grain size of 70 µm or less after the brazing-thermal treatment.

13. A method for manufacturing a heat exchanger tube, comprising:
   - thermally treating a billet or a wire rod at a temperature range between 450 and 650°C. For 10 to 25 hours, the billet or the wire rod being made from an aluminum alloy comprising 0.05 to 0.5 wt % of iron, 0.05 to 0.2 wt % of silicon, 0.3 to 0.7 wt % of manganese, 0.3 to 0.7 wt % of copper, 0.05 to 0.3 wt % of at least one of zirconium and boron, and the remainder of aluminum and impurities; and
   - performing a direct extrusion or a conform extrusion on the billet or the wire rod to manufacture a heat exchanger tube.

14. The method for manufacturing a heat exchanger tube according to claim 13, wherein the content of iron is 0.05 to 0.3 wt %.

15. The method for manufacturing a heat exchanger tube according to claim 14, wherein the content of zirconium or boron is 0.05 to 0.2 wt %.

16. The method for manufacturing a heat exchanger tube according to claim 15, wherein an alloy molten metal is poured at a temperature range between 750 and 900°C to produce the billet by continuous casting or to produce the wire rod by continuous casting and rolling (properzi).
17. The method for manufacturing a heat exchanger tube according to claim 16, further comprising:
   performing thermal arc spraying on the surface of the heat exchanger tube.
18. The method for manufacturing a heat exchanger tube according to claim 17, wherein the heat exchanger tube has a controlled crystal grain size of 50 μm or less after the direct extrusion or the conform extrusion and a controlled crystal grain size of 70 μm or less after the brazing-thermal treatment.

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