The present invention relates to a low lead brass alloy which ensures reduction of harmful to human health effects of lead that is useful for increasing machinability of brass raw material used in tapwares, valves and water meters, in the event of it’s contact with water and which comprises less than 0.25% lead. The inventive brass alloy is an alloy which has machinability, is cost-efficient and environmentally friendly by means of its bismuth content.
LOW LEAD BRASS ALLOY

FIELD OF THE INVENTION

[0001] The present invention relates to a low lead brass alloy which ensures reduction of harmful to human health effects of lead that is useful for increasing machinability of brass raw material used in tapwaters, valves and water meters in the event of its contact with water.

BACKGROUND OF THE INVENTION

[0002] Brass is the general name of the yellow alloys obtained by adding zinc (Zn) to copper (Cu). Brass material is commonly used for production of products such as tapware, valves and water meters. In order to facilitate machining of brass, 1.0 to 1.7% lead (Pb) is added into brass raw material.

[0003] The lead content in brass is desired to be reduced due to the harms caused by lead against environment and human health upon mixing with water. As a result of the researches conducted, machinability is provided to brass raw material by addition of bismuth (Bi), instead of lead, which has characteristics similar to lead and has much less toxicity than lead. After production of these alloys, there are encountered cracks and gaps in the regions where bismuth accumulates due to the fragile structure of bismuth. In order to avoid this and control distribution of bismuth in the material, an alloy known as “mischmetal” is added between 0.05 to 0.30%. Addition of mischmetal prevents bismuth from forming a fragile film at grain boundaries within brass.

[0004] Due to the fact that there is lead within brasses in the technique; after the lead mixes up in the water passing through the armatures, it may harm human health. With making addition of bismuth alone rather than lead addition, the bismuth does not show a homogeneous distribution and it leads to cracks by accumulating at grain boundaries, composing stress in the material. In addition, cost of pure mischmetal is high in order to eliminate negative effects of bismuth.

[0005] In the United States patent document no. U.S. Pat. No. 5,360,591, by means of taking advantage of some of the patents (U.S. Pat. Nos. 5,167,726, 5,137,685, 4,879,094), it is aimed to improve brass characteristics via addition of bismuth by reducing the lead content in the brass. Additionally, it is stated in these patents that, in the event that there is bismuth within the alloy, high amounts of certain elements such as phosphorus, indium and tin must be present within the alloy to offset adverse effects of bismuth. In this patent document there are 55 to 70% copper, 30 to 45% zinc, 0.2 to 1.5% bismuth, 0.2 to 1.5% aluminum, 0 to 1% lead by weight as content of brass and at least two of the elements of B, In, Ag, Ti, Co, Zr, Nb, Ta, Mo, Ti, V as grain refiners.

[0006] In the Chinese patent document no. CN101368238, “stibium” is used instead of lead with the aim of reducing the lead content in the brass. Environmental pollution and its damages for human health are aimed to be eliminated. The content of this invention is composed of 57 to 61% copper, 0.1 to 0.2% tin, 0.1 to 0.5% “stibium”, 0.5 to 0.12% cerium-rich mischmetal less than 0.5% iron by weight and the rest are zinc and impurities.

[0007] In the Japanese patent document no. JP2000169919, a lead-free copper-based alloy having industrial machinability without including lead and excellent corrosion resistance, hot workability and mechanical properties is aimed to be produced.

SUMMARY OF THE INVENTION

[0008] The invention comprises 0.5 to 63.5% copper, 0.5 to 2.0% bismuth, 0.5 to 1.8% tin, 0.2 to 0.7% nickel, 0.04 to 0.4% iron, 0.02 to 0.10% antimony, 0.04 to 0.15% phosphorus and 0.02 to 0.1% mischmetal by weight and balancing amount of zinc and certain impurities.

[0009] In the European patent document no. EP0560590, a free cutting brass containing no lead or small amount of lead is aimed to be obtained. The content of the invention comprises 57 to 61% copper, 0.5 to 4% bismuth (or bismuth and lead), 0.05 to 0.9% mischmetal by weight and a remaining amount of zinc.

DETAILED DESCRIPTION OF THE INVENTION

[0010] The objective of the present invention is to obtain a low lead brass alloy comprising less than 0.25% lead by weight.

[0011] A further objective of the invention is to realize a low lead brass alloy which is produced with machinability by means of its bismuth content.

[0012] A yet further objective of the invention is to realize a low lead brass alloy wherein the bismuth distribution in the brass is controlled by means of its mischmetal content.

[0013] Another objective of the invention is to realize a low lead brass alloy with reduced cost.

[0014] Yet another objective of the invention is to realize an environmentally friendly low lead brass alloy.

[0015] A low lead brass alloy realized to fulfill the objective of the present invention is illustrated in the accompanying figures wherein:

[0016] FIG. 1 is the 500 times enlarged view of the microstructure of the ingot with bismuth which is produced by addition of Fe-Mg-RE based mischmetal.

[0017] FIG. 2 is the 500 times enlarged view of the microstructure of the ingot with bismuth which is produced by addition of Fe-Si-RE based mischmetal.

[0018] FIG. 3 is the 100 times enlarged view of the microstructure of the ingot with bismuth which is produced by addition of Fe-Mg-RE based mischmetal.

[0019] FIG. 4 is the 200 times enlarged view of the microstructure of the ingot with bismuth which is produced by addition of Fe-Si-RE based mischmetal.

[0020] In the production of the inventive low lead brass alloy; copper, zinc, bismuth, aluminum, boron and other elements are melted in a melting furnace. The mixture is casted by a die casting method. Then, brass ingots are obtained from which tapwaters suitable for polishing, coating and machining will be produced and which are qualified to be used in a low-pressure casting process.

[0021] The low lead brass alloy comprises 55 to 65% copper (Cu), 0.5 to 2.0% bismuth (Bi), 0.1 to 1.0% aluminum (Al), 5 to 10 ppm boron (B), 0.05 to 0.30% mischmetal, other metals which are comprised of less than 0.1% iron (Fe), manganese (Mn), nickel (Ni), tin (Sn) and less than 0.25% lead (Pb) by weight.

[0022] In one embodiment of the inventive low lead brass alloy, the mischmetal mixture (Fe-Mg-RE) consists of 5 to 19% iron (Fe), 1 to 4% magnesium (Mg), 75 to 93% rare earth (RE).

[0023] In another embodiment of the inventive low lead brass alloy, the mischmetal mixture (primary Fe-Si-RE) consists of a mixture of 50% iron (Fe) and silicon (Si) and 50%
rare earth. The content of the rare earth consists of 49 to 59% cerium (Ce), 29 to 39% lanthanum (La), 0 to 10% neodymium (Nd) and 0 to 7% praseodymium (Pr).

[0024] In a further embodiment of the inventive low lead brass alloy, the mischmetal mixture (secondary Fe-Si-RE) consists of 20 to 40% iron (Fe), 20 to 40% silicon (Si), 20 to 60% rare earth and a remaining amount of other elements (aluminium, calcium, titanium etc.). The content of the rare earth used in these mischmetals consists of 40 to 65% cerium (Ce) and 25 to 50% lanthanum (La).

[0025] The inventive addition of mischmetal prevents the bismuth from accumulating at the grain boundaries. Thus the bismuth disperses in the form of a droplet in a microstructure, like lead (FIG. 1-FIG. 4).

**TABLE 1**

<table>
<thead>
<tr>
<th>STANDART</th>
<th>Hardness (HB) min. 110</th>
<th>Tensile Strength (N/mm²) min. 350</th>
<th>% Elongation min. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Inventive Ingot</td>
<td>107</td>
<td>339</td>
<td>11.7</td>
</tr>
<tr>
<td>Ingot with Bismuth-Mischmetal</td>
<td>111</td>
<td>350</td>
<td>11.3</td>
</tr>
</tbody>
</table>

[0026] Considering the mechanical properties of the ingot with bismuth-mischmetal and the inventive ingot there are standards relating to rod sample taken from leaded ingots which are used in the prior art, in the production of tapwears. Whereas the inventive ingot is the values of the rod sample, which is taken from the leaded ingot alloy produced in accordance with standards, obtained as a consequence of its mechanical and hardness tests. The ingot with bismuth-mischmetal is the tensile test values of the rod sample taken from the alloy with mischmetal which is added in order to achieve homogeneous distribution of the bismuth that is added instead of lead and prevent it from accumulating at grain boundaries (Table 1).

[0027] Mechanical and hardness properties of the rod sample which is prepared from the alloy of the mischmetal added ingots with bismuth, substantially fulfill the values stated in the standard and can give better results than the sample taken from the standard leaded ingots (Table 1).

[0028] Within the scope of these basic concepts, it is possible to develop a wide variety of embodiments of the inventive “Low Lead Brass Alloy”. The invention cannot be limited to the examples described herein; it is essentially according to the claims.

1. A low lead brass alloy used in all brass based products that contact with water such as tapware, valves and water meters

   comprising 55 to 65% copper (Cu), 0.1 to 1.0% aluminum,

   5 to 10 ppm boron (B), other metals which are comprised of less than 0.1% iron (Fe), manganese (Mn), nickel (Ni), tin (Sn) by weight,

   characterized by 0.5 to 2.0% bismuth (Bi), 0.05 to 0.30% mischmetal and less than 0.25% lead (Pb) by weight.

2. A low lead brass alloy according to claim 1, characterized by mischmetal which is comprised of a mixture of 5 to 19% iron (Fe), 1 to 4% magnesium, 75 to 93% rare earth.

3. A low lead brass alloy according to claim 1, characterized by mischmetal which is comprised of a mixture of 50% iron (Fe) and silicon (Si) and a mixture of 50% rare earth.

4. A low lead brass alloy according to claim 1, characterized by rare earth which is comprised of a mixture of 49 to 59% cerium (Ce), 29 to 39% lanthanum (La), neodymium (Nd) between 0 to 10% and praseodymium (Pr) between 0 to 7%.

5. A low lead brass alloy according to claim 1, characterized by mischmetal which is comprised of a mixture of 20 to 40% iron (Fe), 20 to 40% silicon (Si), 20 to 60% rare earth and a remaining amount of other elements.

6. A low lead brass alloy according to claim 5, characterized by rare earth which is comprised of a mixture of 40 to 65% cerium (Ce) and 25 to 50% lanthanum (La).