Since the production of HPSSS was organized in specialized shops, the manufacture of more than 4000 types of shapes has been mastered (Fig. 3). Special shapes are also made in the specialized shop at the Leningrad Turbine Blade Plant and, in small quantities, at the Leningrad Steel-Rolling Plant and Belorutsk Metallurgical Combine. The range of special shapes made by metallurgical plants is shown in the catalog "Ordinary and Special High-Precision Shapes," published in 1981.

The specialized shops at the OMZ and CherSPZ have now mastered the production of more than 900 types of shapes, with a cross-sectional area ranging from 4 to 6000 mm². In 1978, these shops exceeded their design capacity by a factor of 2-2.5.

Plans call for plants under the Soviet Ministry of Ferrous Metallurgy to master the production of 30 new types of shapes in 1984 and 1985. By the end of the Eleventh Five-Year Plan it is anticipated that the volume of production of HPSSS will have increased by a factor of 1.6 due to the construction of a specialized shop to make elevator guiders at the OMZ and modification of the existing specialized shop at the CherSPZ.

To completely satisfy the needs of the national economy for HPSSS, it will be necessary to reconstruct the present specialized shop at the OMZ and to build a new specialized shop at one of the plants in the sector.

Thus, coordinating the work being done on producing high-precision specialized shapes is helping the metal-consuming plants of the country, and the direct participation of TsNII-chernet in mastering new shapes makes it possible to apply research findings within the period of a year.

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**HOT GALVANIZING OF TUBES IN AN ALLOYED ZINC MELT**


The Severskii Pipe Plant is the first plant in domestic practice to introduce the galvanizing of pipes in a zinc melt alloyed with nickel, manganese, and aluminum. Liquid-phase galvanizing is a widespread and effective method of protecting steel products from corrosion. Despite the fact that this process is widely known in international practice, its possibilities are far from being exhausted.

One of the methods available for increasing the corrosion resistance and improving the physicomechanical properties of zinc coatings is alloying the zinc melt with different metals. This is due to the fact that alloyed coatings consist of corrosion-resistant zinc alloys which are covered during service by stable protective films of complex composition.

As a rule, the corrosion of zinc coatings in water diminishes over time, and alloying the coating accelerates the onset of this reduction in corrosion. Also, corrosion products

<table>
<thead>
<tr>
<th>Alloyi ng element</th>
<th>Content of element in zinc melt, % by wt.</th>
<th>Quantity of element needed for 1 ton of zinc, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>0.07—0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.01—0.085</td>
<td>0.05</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.025—0.065</td>
<td>0.03</td>
</tr>
</tbody>
</table>

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which are strongly bound to the base metal are formed on alloyed zinc coatings, and these products also have protective functions.

The selection of a method of alloying is dictated by the specific production conditions. Alloying can be done in two ways: by direct introduction of the alloying additions to the zinc melt in the form of the corresponding metals; by the introduction of prepared master alloys based on zinc. The first variant is more convenient, since it does not require the preparation of special master alloys. However, the introduction of metals in the form of pigs or sheets into the melt requires a long time for their dissolution. One pig of metallic magnesium weighing 7-9 kg requires 15-20 min to dissolve in a zinc melt.

Master alloys (zinc-aluminum, zinc-magnesium, and zinc-nickel) are used often to alloy zinc melts. After they are prepared they are checked in a fracture test. The structure of the alloy in the fracture surface should be uniform, fine-grained, and free of pores.

The Severskii Pipe Plant has used a method of alloying which makes it possible to easily saturate a commercial 200-ton galvanizing bath full of zinc with alloying elements. The aluminum and magnesium are introduced using a welded sievelike container made of steel rods 15-20 mm in diameter. The bath is alloyed with nickel by dissolving sheets welded about the perimeter of the bath. Before the zinc melt is alloyed, the necessary quantity of alloying elements is calculated in accordance with a table.

The metal required for alloying is placed in the container and immersed in the galvanizing bath below the level of the zinc melt. Use of the container, along with circulation of the zinc by the galvanizing mechanism and the rotating pipes, helps rapidly dissolve the alloying elements in the zinc melt. The pipes are prepared for galvanizing by the following scheme:

1. Washing. A bundle of tubes is immersed in a bath with hot stationary water (75±10°C) for 1-5 min. Various contaminants are removed from the pipe surface here, which facilitates subsequent degreasing.

2. Degreasing. The composition of the solution, g/liter: 30-90 trisodium phosphate; 0.2-0.6 emulsifier; temperature 80 ± 10°C, holding time in solution no more than 9 min.

3. Washing pipes in bath with hot (75 ± 10°C) water for 2-5 min to remove the degreasing solution from their surface.

4. Pickling. Composition of solution, g/liter: 180 HCl, 0.1 KhOSP-10 inhibitor. Solution temperature 35-40°C, holding time 30 min.

5. Washing pipes in cold running water for 1 min to remove residues of the pickling solution and slime from their surface.

6. Secondary pickling in an aqueous solution of hydrochloric acid (80-140 g/liter) at 15-30°C for about 1 min.

7. Washing pipes in a bath with cold (15-30°C) running water for 1 min.

8. Fluxing in a solution of the following composition, g/liter: 790 zinc chloride, 116 ammonium chloride. Solution temperature 60 ± 5°C. Tubes are held in solution for 40 sec. A bath with a mechanism to rotate each pipe individually is used for this operation.

Fig. 1. Microstructure of zinc coating obtained at 460 ± 5°C with a galvanizing time of 35 sec in a melt alloyed with 0.04% aluminum, 0.01% magnesium, and 0.08% nickel, ×300.