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THE FAVORABLE INFLUENCE OF Ni ON THE REDUCTION OF SEGREGATIONS DURING SOLIDIFICATION OF LEAD-TIN BRONZES CuSn10Pb10

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Abstract

Alloys from the group of lead-tin bronzes (CuSn10Pb10) are most often used for the production of sliding bearings with significantly improved sliding (anti-friction) characteristics in difficult lubrication conditions in the exploitation process itself.

These bronzes are characterized by pronounced inhomogeneity caused, on the one hand, by the decrease in the solubility of lead in a solid copper solution with a decrease in temperature, and on the other, by the difference in density. The aim of this work is to examine the impact of nickel on the reduction of segregation, i.e. the distribution of lead, which has the greatest influence on inhomogeneity in the process of solidification of the mentioned alloys throughout the entire volume.

Three alloys with different nickel content were tested: 0%, 0.48%, 2.12%. Alloys are melted in a pot flame furnace with a blue flame at the furnace mouth in a slightly oxidizing atmosphere. The melting temperature was 1135 0C. Sliding bearings were gravity casted in molds made from a molding mixture of bentonite and silicon dioxide. A scanning electron microscope was used for microstructural tests. Test samples of identical shape and size were taken from the same casting zones. The problem that caused the inhomogeneity is primarily the decrease in the solubility of lead in copper during the solidification of the alloy. Namely, the solubility of lead in copper at a temperature above 1083 °C is 38%, while at room temperature it is 0.002%. Additional inhomogeneity is caused by the difference in the density of the base and alloy elements, which causes gravitational segregation. The basic characteristic of nickel as an alloying element in copper alloys is that it creates a dendritic microstructure during the crystallization process. The addition of nickel to lead-tin bronze alloys affects the even distribution of lead in the interdendritic space throughout the entire volume of the casting. In this way, a uniform distribution of lead is obtained, which has the basic function of improving the sliding properties of these alloys, and thus the uniformity of the sliding properties and mechanical characteristics of the sliding bearing is obtained.

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