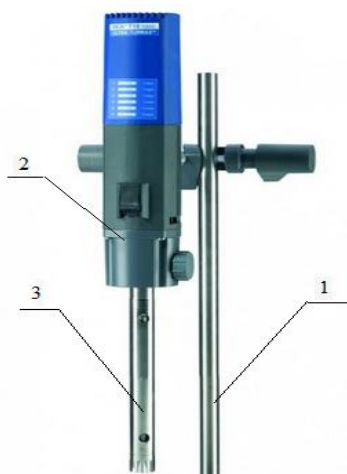


## Research on the development of a water-based composition of a release coating for molds for casting aluminum alloys under pressure

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The technology for preparing the release coating composition was carried out on the basis of the settled fuse fraction according to the following scheme: precise dosing of the components for the preparation of lubricant compositions was carried out using a glass cylinder 3-250-2 GOST 1770–74 "Measuring laboratory glassware. Cylinders, beakers, Flasks, Test tubes. General Specifications", mixing of the components was carried out in a beaker 250 GOST 1770–74, using a laboratory mixer and a Basic T18 Ultra-Turrax disperser mounted on a stand. Figure 1.1 shows the appearance of the Basic T18 Ultra-Turrax disperser.

The use of this dispersant made it possible to change the mixing frequency of the initial components in the range from  $3\,500\text{ min}^{-1}$  to  $24\,000\text{ min}^{-1}$ . The initial components were heated in a heat-resistant glass beaker with a capacity of  $0.25\text{ dm}^3$  using an electric stove. The heating temperature of the initial components before mixing was controlled using a mercury thermometer immersed in the volume of the prepared lubricant. At the same time, the thermometer did not touch the bottom of the beaker in order to exclude distortion of the temperature measurement results in the lubricant volume. The mixing time of the initial components during the preparation of the lubricant composition in all cases was 10 minutes.



1 - tripod guide; 2 – disperser; 3 - removable nozzle baking powder

**Figure 1.1 – Appearance of the disperser model Basic T18 Ultra-Turrax**

As a surface-active substance (surfactant) necessary to obtain an aqueous emulsion with high sedimentation stability, the following were chosen: nonionic surfactant (neonol) and anionic surfactant (liquid soap, produced by the Republic of Belarus) in an amount of (2.0% and 0.5% of the volume of the prepared emulsion, respectively). The accepted percentage of surfactants in the composition of the release coating being developed corresponds to the recommendations set forth in and is based on the principles of obtaining colloidal solutions, namely, obtaining an O/W oil-in-water emulsion. The principle of obtaining a stable emulsion of type O/W based on saturated and unsaturated fatty acids (stearic ( $C_{17}H_{35}COOH$ ) and oleic ( $C_{17}H_{33}COOH$ ) acid) and water is the need to use nonionic and anionic surfactants.

Water was used as a diluent. Water served as a diluent. This type of diluent (water) has the most beneficial effect on cooling the surface of the mold before pouring the liquid melt due to the high heat capacity of water. In addition, the use of water as a diluent makes it possible to obtain aqueous emulsions of a release coating, which in turn makes it possible to mechanize and fully automate the process of applying lubricant to the mold surface.

It should be noted that preliminary studies were carried out to determine the degree of influence of the type and amount of surfactant introduced into the lubricant composition, the heating temperature of the components, the frequency and time of their mixing on the sedimentation stability of the developed lubricant composition for die casting aluminum alloys. Studies have shown that the optimal quantitative and qualitative composition of the release coating can be as follows: fuse – 25–40 %; Surfactant – 2.5%; water – 67.5%.

In order to obtain a water-based release coating with the highest lubricity, it was decided that the final amount of fuse in the lubricant would correspond to the maximum value (40% by volume). With this amount, the amount of surfactant remains unchanged and amounts to 2.5% of the volume, and the amount of water will be 57.5% of the volume.

The optimal temperature for heating the components varied in the range of values from 70 °C to 90 °C. At a lower heating temperature of the initial components (below 60 °C), it was not possible to obtain a stable emulsion. Thus, in the future, when conducting research on the development of the composition of the release coating, the heating temperature of the initial components was 75 °C.

Initially, mixing of the initial components used to obtain the release coating composition was carried out using a laboratory mixer with an operating frequency of up to 1300 min<sup>-1</sup>. The mixing time of the components was 1 min. The sedimentation stability of the water-based lubricant prepared with the above technological parameters did not exceed 2 hours.

Further studies were carried out taking into account the change in the mixing frequency (up to 24 000 min<sup>-1</sup>), while the heating temperature of the initial components was 75 °C as before due to the use of the Basic T18 Ultra-Turrax disperser. Table 3.1 presents the results of a study of the influence of the mixing frequency of the initial components on the sedimentation stability of a water-based release coating for die casting molds of aluminum alloys.

Table 1.1 – The results of the study of the influence of the mixing frequency of the initial components on the sedimentation stability of the water-based separating coating for die casting molds of aluminum alloys under pressure

Sedimentation stability of the resulting water-based lubricant, days	The frequency of mixing of the initial components used in the development of the water-based composition of the lubricant, min <sup>-1</sup>					
	4 000	8 000	12 000	16 000	20 000	24 000
	4	13	17	22	29	38

It can be seen (table 1.1) that the value of sedimentation stability increases with an increase in the frequency of mixing of the initial components. At the same time, an increase in the value of sedimentation stability by more than 3 times is observed at a mixing frequency of the components from 4 000 min<sup>-1</sup> to 8 000 min<sup>-1</sup> and is 13 days. A further increase in the mixing frequency of the components from 16 000 min<sup>-1</sup> to 24 000 min<sup>-1</sup> leads to an increase in the value of sedimentation stability up to 35 days.

As a result of the research, it was found that the frequency of mixing of the initial components has a significant effect on the sedimentation stability of the separating coating. At a mixing frequency of 24 000 min<sup>-1</sup>, the sedimentation stability of the developed separating coating composition exceeded 1 month.