Aluminium lost-foam casting production

INTRODUCTION:

Aluminium and its alloys place the second after steel on the volume of production and consumption.
Alloys are most widely used in machine construction, aviation and space engineering, metallurgy, radio engineering, electronic engineering, chemical industry, etc.

In the lost-foam casting (LFC) technique, a disposable polystyrene foam (foam) model, which burns out during casting and gets totally replaced by metal, is used.
In the LFC technique, such operations as mixture preparation or production of cores are absent; and moulding is replaced with vibration compaction.

1-MELTING OF ALUMINIUM ALLOYS:

Aluminium belongs to both light and fusible metals. Fusion temperature of pure aluminium at atmospheric pressure is 658 °C. Its density at room temperature is 2,7 g/cm^3[8].

An advanced method for melting aluminium alloys in foundries with serial production is the induction heating by currents of industrial, average and high frequency. For aluminium alloys the most suitable are open induction crucible furnaces.

2- SECONDARY REFINING (REFINEMENT, MODIFICATION)

2.1 REFINEMENT:

Considerable part of hydrogen in aluminium alloys is coupled in complexes with aluminium oxide $xH \cdot yAl_2O_3$. Therefore removal of hydrogen leads to diminishing of Al2O3 in the molten alloy and vise versa.

During the melting process, aluminium alloys are capable to active acidification and consumption of hydrogen; therefore an important stage of melting is refining which can be conducted by degassing (Ar) in a furnace, evacuation, or salt baths.

2.2 REFINEMENT OF ALUMINIUM ALLOYS BY DEGASSING:

Refinement of alloys by degassing with gases inert towards aluminium is conducted under implementation of two processes:

- removal of hydrogen diffused into a bubble of inert gas;
- removal of inclusions by means of floating influence of gas bubbles.

2.3 MODIFICATION:

It is known that modification of eutecticum in silumins results in improving of physical and mechanical properties of these alloys. Nowadays more than forty elements which have modifying influence on the structure of eutecticum in silumins are known.

Also, an inseparable stage of the melting process is the modification for the purpose of structure refinement. Modifying additional alloy of aluminium and strontium is effective.

3 . LOST-FOAM CASTING TECHNIQUE

This technique can be related to the number of ways for obtaining castings in nondetachable molds on disposable model as investment casting. Nevertheless, despite similar methods, a model is removed (gasified) not before the casting, but during the molds casting with metal which fills the vacated space in the mold's cavity, replacing the evaporating model.

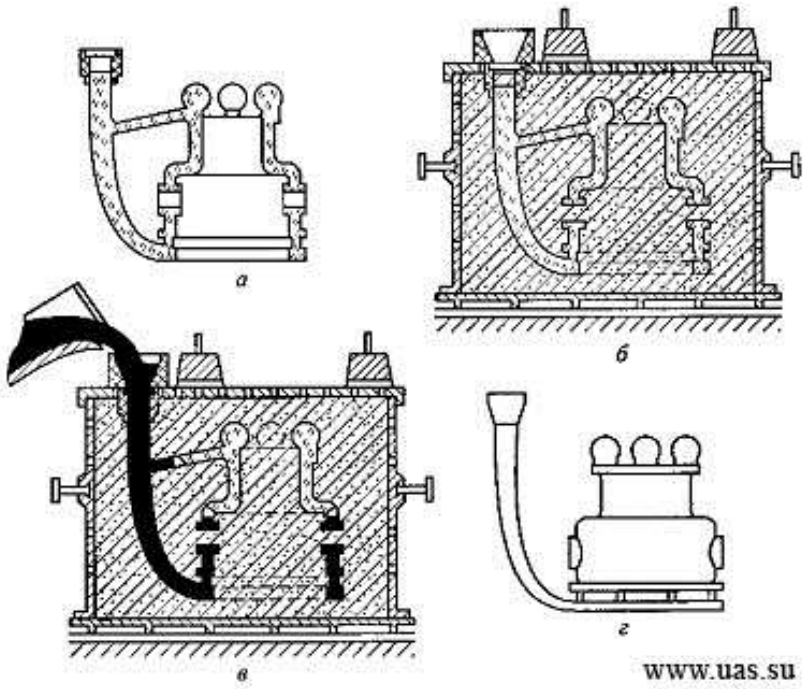

Figure 3.1 – Scheme of the lost-foam casting production: а – polystyrene foam casting model; б – a mold prepared for casting; в – mold casting, gasification of the model; г – casting with elements of the pouring gate system

Figure 3-2 – Shell-mould casting system

DISOPAST 7061 coating is a water-based ceramic coating intended for the use in the lost-foam casting production. The coating is specially developed for castings of aluminium and aluminium alloys. The coating guarantees high heat resistance, permeability, and under proper use provides perfect casting's surface without defects.

The DISOPAST 7061 coating is characterized by

– good adherence to the majority of polystyrene models' surfaces;

– high abrasion resistance after drying out;

– low settleability under exploitation and transportation;

– easy removal from the casting's surface.

Technical properties /32/:

– basic filler	refractory silicate;
– liquid phase	water;
– filler content, %	not less than 65;
– density (at 20˚C), kg/m^3	1480;
– viscosity (by 6 mm Ford cup), sec	12…15;
– coating thickness on vertical surfaces, mm	0,5…0,9.

CONCLUSION

Lost-foam casting (LFC) is one of the newest methods for castings production, which appeared as a result of scientific and technical revolution in the latter half of the 20^{th} century. Such technique, called the lost-foam casting, solved the most important problem of foundry engineering – increasing casting accuracy to the level of investment casting considering cost for production of sand-and-clay mold casting.

Advantages of the lost-foam casting (LFC) technique:

- possibility for production of castings of complex configuration;
- high accuracy of obtained castings, even with complex configuration;
- possibility for obtaining thin-gage steel castings;
- quality and density of the casting metal is provided by means of partial vacuum treatment in the casting process;
- high quality of castings' surfaces;
- minimal allowance for machining;
- increased dimensional accuracy of castings;
- diminished expenditures for equipment and materials;
- decrease of manufacturing wastes;
- the use of different alloys of ferrous and nonferrous metals for casting.