

Vacuum moulding plants as a pollution-free way of manufacture

In this article we will try to tell about a pollution-free way to molding of products – vacuum moulding plants. This type of molding was chosen for manufacture of elements styled after the Kulay culture. This technology is used at many enterprises, as one of the universal ways of molding where the ultimate goal is high detalization. Vacuum moulding is a recent and prospective method of moulding.

For a start we want to pay attention to environmental friendliness of foundry production which is maintained by means of introduction in production of this technology. Process of vacuum moulding is silent, and also pollution-free as during filling and initial cooling the forms are under vacuum venting, so all gases proceeding from a form may be filtered, and workers can work in comfortable conditions.

In this work we will describe process of technology, we will consider its advantages and disadvantages. The method is based on evacuating in a hollow submodel plate, and subsequently and in shape, the vacuum provides the dense fitting of a contour of model with a thermoplastic film and keeps stability of a form when filling and cooling.

The technology of vacuum moulding plants consists in creation of a casting mold by means of a thermoplastic film. The main characteristic of this technology is use of dry quartz sand and a thin plastic film with a vacuum pressure from 0,3 to 0,6 bars. Process of manufacture of a model consists of several stages. For creation of mold piece it is required to prepare a molding box, a submodel table, models for mold pieces and check operation of a vacuum pump. Then a choke is fixed on a submodel table which is mounted on a vacuum chamber and the model is tightly attached to it. The cavity of a vacuum chamber is connected by thin channels with the surface of a plate and model. The synthetic film of no more than 0,1 mm thick with an area equal to that of a model plate, is heated to plastic condition for some time. The warmed film is imposed over model and is connected to the chamber cavity through a pipe and then to the vacuum pump. Then the vacuum pump evacuates air from the cavity. Therefore, because of action of a vacuum pump the film densely adjoins to a model, which becomes similar to the desired product. A double-walled flask equipped with a pipe to pump air through a special filter is placed on top. Metal feeding riser is installed onto the main feeder to feed metal. Next, you need to cover the film-covered model with chromium oxide, to avoid burning of the molding sand and wait until chromium oxide dries. The internal cavity is filled with a special dry molding sand. Small vibration helps achieve compaction of sand, excess material is removed and the double-walled flask is covered over with synthetic film (no heat) required to seal the molding sand. Then, the valve of evacuating air pipe is opened, whereby there is a vacuum in the molding sand. To remove the double-walled flask from the table of molding the vacuum chamber is disconnected from the vacuum pump. Next, the double-walled flask should be covered with a refractory material, leaving a hole for the flood basin. Then molten metal is poured into the funnel gating system. After solidification of the metal you want to disable the vacuum pump, which causes the casting with gating system to fall out of the flask. This method of vacuum moulding can be used to cast various products [2].

The advantages of this method:

- no pattern wear
- high quality molding products
- high and uniform hardness of the product
- ease of extraction from the mold
- ability to manufacture thin-walled castings

- long life of the mold and flask
- simplicity of the equipment used

Vacuum film moulding is very efficient in manufacture of molds to cast housings for pumps and gears for acid and caustic service, pressurized equipment. This method is also used to produce sealing gaskets for industrial and marine parts [3].

The process of vacuum moulding is also well suited for the production of products with a large range of sizes, from tiny up to 10 meters. It also allows the production of castings with a guaranteed second class precision, and casting weight is reduced by 10–15 %. The manufacture of one batch of parts by vacuum-film method takes 1–1.5 hours.

While studying this method of casting metals we have been able to make two bronze copies of Kulay culture artifacts.

Such products can also be produced by lost-wax method of casting. This technology allows very precise detalization of the model. But this technology allows only one copy per model because the model drips out during the manufacture of forms, has a relatively high cost of molding materials, increased release of harmful chemicals in the model thermic removal stage [1, c. 49].

At the same time, vacuum moulding allows the unlimited reuse of model, is rather inexpensive and is very eco-friendly. Environmental friendliness of this process is that substance of process of vacuum moulding plants it use as forming material only of clean sand without binding chemical additives, and also forms during filling and initial cooling are under vacuum venting of all gases proceeding from a form.

Also it was possible to use injection molding. It is very precise method of molding providing the mold pieces, in many cases which are not requiring padding machining besides it is pollution-free method of production. But injection molding is feasible only for mass production because of difficulties and prohibitive costs of form manufacture [1, c. 51].

Vacuum moulding may be used together with another modern technology: 3D printing. 3D printed models are still quite expensive, but if used as a model for small scale run of vacuum moulding formed copies it is highly feasible. Also, it allows metal copies of 3D printed models to be produced at ease.

References

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