



SANITARY SILICONE USED TO MAKE SMALL ART CAST PARTS

Tibor BEDŌ, Viorel ENE, Ioan CIOBANU

Transilvania University of Brasov, Faculty of Materials Science and Engineering
email: bedo.tibor@unitbv.ro

ABSTRACT

Also known as investment or precision casting process, the "lost wax process" was used in ancient times from China to Egypt to cast exquisite objects which are now displayed as artifacts in museums. The process is called "lost wax" because the wax is lost or burned off in the process. The process starts with the making of a rubber mould of an original piece. The rubber mould is then used to create wax duplicates of the original piece. The mould making process is an art in itself and requires a skilled craftsman to create a good long lasting mould. The paper presents the use of "sanitary silicone" to make "rubber mould".

KEYWORDS: lost wax process, sanitary silicone, plaster mould

1. Introduction

Metal casting is an ancient technique that has a variety of applications and purposes. Civilizations from the dawn of time to present day have used metal working as a way of creating artistic, religious, and practical items.

The process of metal casting involves melting metals at high temperatures and using molds to then shape the metal into new items. Metal casting is just one form of metal working that has seen a recent surge in popularity as resources are becoming more affordable and communities are springing up to share information, ideas, and projects [1].

While metal casting is used on an industrial level as the process cuts cost and proves to be highly efficient, many individuals participate in metal casting as a hobby and in artistic endeavors.

Many people are drawn to metal casting for one reason or another, although there seems to be two main motivations that stand out.

The first motivation that brings hobbyists to practice metal casting is need; people may need to create items or parts for other ventures. Metal casting is a great way to build hard to find pieces for models, restoration projects, and even just small replacement parts needed for common household items. The second motivation for using metal casting is using it as a way to create sculptures or other artistic endeavors. Metal casting is only limited by the individual's desire, so for those with the time and the need, virtually anything is possible.

There are many types and kinds of art casting: wax art casting, sand art casting, lost wax casting and many more.

The Lost Wax Casting process is the preferred method used when art casting. This process was used in ancient times to create bronze items. Small foundries like the type found in backyards, personnel workshops, and garages are able to use the "lost wax casting" process with a certain amount of professionalism.

2. The "rubber mould" made by sanitary silicone

Most of the art casting of lost wax is processed by use of lost wax ceramic method of casting. This can make it a possibility of reproduction of maximum detail from original concept. Smaller works like the abstract works, animal figures and many more are designed on such department.

The lost wax casting process is rather simple when compared to other casting methods but it can be time consuming and attention to detail is important. The artists will start with an original piece sculpted from wax, clay or even metal. The original will be used to make the mould. If the piece to be cast is large, multiple moulds will be needed. A mould is made from the pattern using flexible gel or similar rubber-like materials stabilized by a plaster jacket of several pieces.

To achieve mould from the pattern we have used sanitary silicon which adheres well to most building

materials such as ceramics, glass, wood, aluminium, etc. (so, even materials that can be executed models).

Next are the technical features of sanitary silicone used in the experiments (given by manufacturer [2]):

- skin-forming time at 23 °C 25 min
- extrusion rate 800 g/min
- density at 23 °C 0,98 g/cm³
- tensile strength 0,6 N/mm²
- ultimate elongation 200 %
- hardness, Shore A 18
- tear strength 4,0 N/mm
- movement capability 20 %
- temperature resistance (cured product)
-40 °C . . . +100 °C

Because the mould making process is an art in itself, was chosen as a model a conical wheel made of steel (Figure 1).



Fig. 1. The conical wheel used in the experiment.

The conical wheel metal model was coated with a layer of 4-5 mm sanitary silicone and, after that, was left to dry for 24 hours. After drying the silicone layer was sectioned and the model was removed from inside.

The result was a mould of sanitary silicone, as shown in Figure 2. Once the mould was finished, molten wax was poured into it to fill the entire mould. The molten wax was left to cool until it solidified completely.

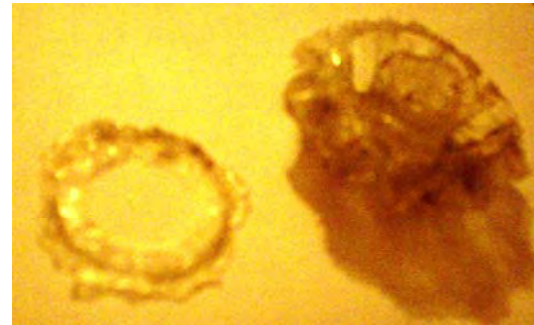


Fig. 2. The sanitary silicone mould.

This wax copy of the original model was removed from the mould and became the casting pattern itself (Figure 3).



Fig. 3. The wax copy of the model.

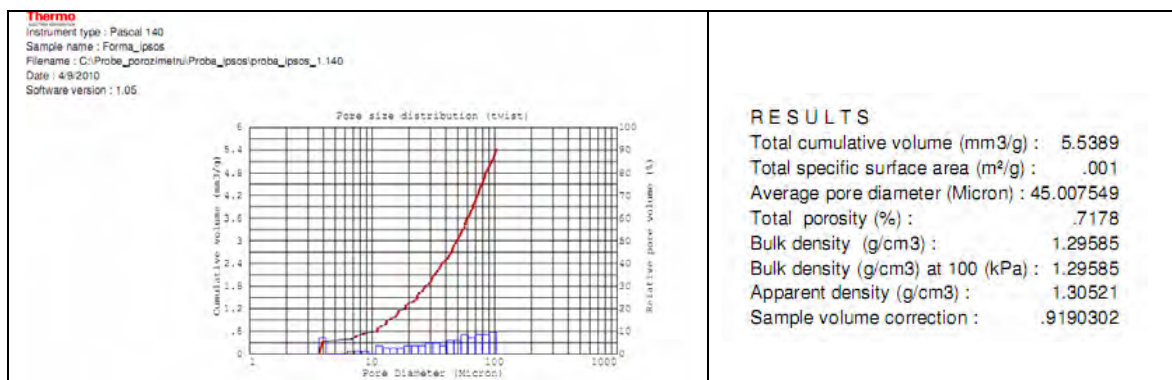


Fig. 4. The porosity of the plaster mould.

On the wax copy of the model were glued the casting gate pattern and the vent tube pattern.

Concerning the vent tube some clarifications should be made. The mould will be made of plaster. The mould porosity determination was made with a THERMO PASCAL 140 porosimeter resulting in a porosity of about 0.7% (Figure 4). Given the low value of porosity the discharge of gas from the mould is difficult. For this reason, and in order to completely remove the wax pattern from the plaster mould, was taken into consideration a bigger vent tube section (Figure 5).

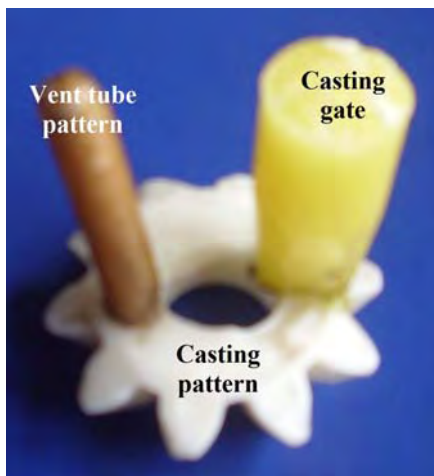


Fig. 5. The wax casting pattern.



Fig. 6. The mould box.

The wax casting pattern was placed into a mould box and plaster was cast around it (Figure 6). The plaster mould was left to harden for 48 hours.

The hardened plaster mould was placed cup-down in a laboratory furnace, at 250°C, whose heat hardened the plaster, and the wax melted and ran out.

Now all that remained of the original work is the negative space, formerly occupied by the wax, inside the hardened plaster mould. In the plaster mould were made sections and its structure has been examined under a microscope (Figures 7 and 8).



Fig. 7. Section in the mould ready for casting.

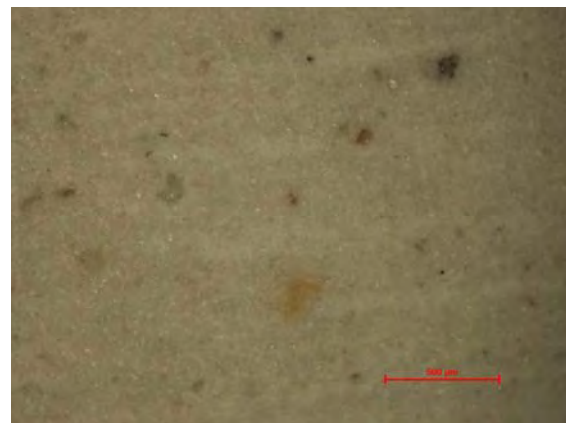


Fig. 8. Plaster mould structure (10x).

The plaster mould is reheated in the kiln to harden the patches and remove all traces of moisture, then placed cup-upwards into a box filled with sand, and molten metal is poured through the ducts, filling the space left by the wax [3]. When cooled, the outer plaster is removed, and the metal may receive finishing touches.

3. Conclusions

Based on these experiments we can tell:

- to cast small parts of category parts with average geometrical configuration, small pieces of art, we can use plaster casting moulds;
- lost-wax process is best used for the pieces in this category;
- to achieve the mould where will be poured the wax (to be a faithful copy of the original model) the sanitary silicone can be used, with good results;
- to obtain a good silicone mould, the silicone thickness must not exceed 8 – 10 mm;



- the optimum silicone mould release is performed between 24 and 30 hours of coverage model with the silicone layer.

We can say that inner moulds are usually made of latex, polyurethane rubber or silicone, which is supported by the outer mould.

References

- [1]. <http://www.metalcastingzone.com>
- [2]. <http://www.penosil.com/en/Products/silicone-and-acrylic-sealants/penosil-standard-sanitary-silicone>
- [3]. http://en.wikipedia.org/wiki/Lost_wax_casting