

Polymeric Patterns to Fabricate Ceramic Shell Moulds

P. Venkateswara Rao

M.Tech Student, Department of Mechanical Engineering, Osmania University, Hyderabad



Under the Guidance of Dr. A. Chennakesava Reddy, Associate Professor, Department of Mechanical Engineering, Vasavi College of Engineering Hyderabad.

ABSTRACT

The patterns used currently on the investment casting process are too complex, highly accurate size is needed. These patterns are made of raw materials with low melting points such as: wax, gels, tin, bismuth, antimony, etc. However, during the removal of these patterns from inside of the ceramic mold, is common to develop cracks or, in more severe cases, fracture of the mold due to the expansion of the raw material with increasing temperature.

This project work consists in the manufacturing of polymeric patterns using rapid prototyping technologies. Such patterns are used on the investment casting process to fabricate ceramic shell molds.

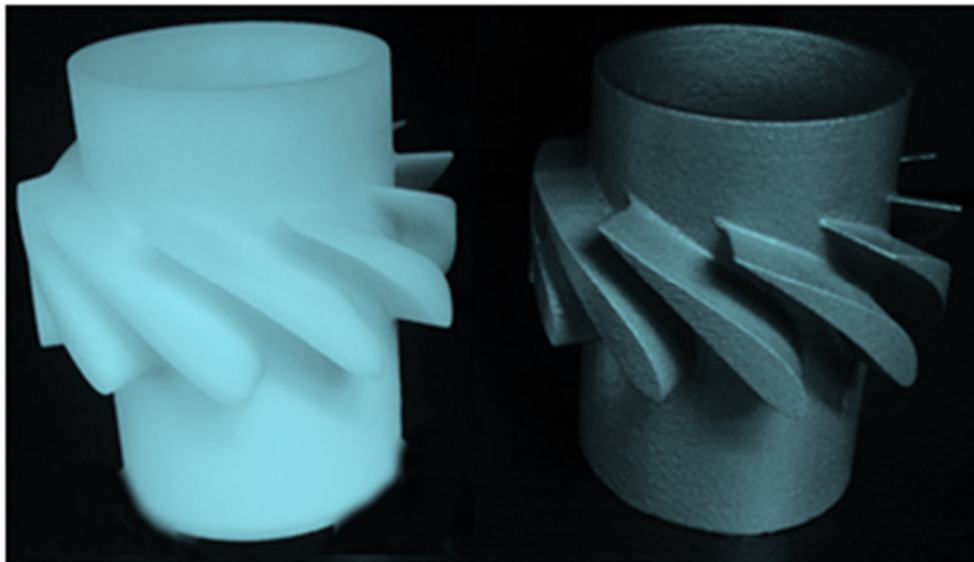


Figure 1: Application of investment casting process.

The process consists in the preparation of 3 to 15 ceramic layers leading to a final 1 to 20 mm thickness. The first layer corresponds to the immersion of the patterns in the ceramic slurry; which is the most important step as the mud is in direct contact with the pattern reproducing its surface. Subsequent layers are formed in two steps: the immersion of the piece in the slurry that acts as a binder and the adhesion of the silica sand on the piece surface. The pieces are then left to dry 30 minutes to 24 hours between each ceramic layer allowing to proceed with the extraction of the polymer after the last layer. Patterns extraction is made when the ceramic shell is heated between 400 to 900 °C to achieve the burning of the polymer; temperature is then raised to a range of 900 to 1300 °C to remove the polymer by evaporation and sintering the shell ceramic in order to support the metallostatic pressure during the casting and increasing its hardness and strength, leaving the cavity completely free for the entry of the molten metal.

No cracking or fracture was found in the ceramic shell obtained, produced by this new method. It was observed a considerable time and material savings compared with traditional investment casting process, because the model is used directly as a pattern without having to go through the traditional wax lost manufacture proce.

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