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3D printing of sand moulds allows foundries to be a step ahead

Technology with many advantages

Sand casting moulds from 3D printers offer numerous advantages – from shorter throughput times and less follow-up work to better surface quality of unfinished castings. The initial experience of pump manufacturer Nijhuis with voxeljet's printing technology has been positive.

Dutch pump manufacturer Nijhuis casts both pump housings as well as wheels weighing up to 800 kg at its Winterswijk location. The Dutch firm has already concluded several projects with voxeljet. voxeljet operates one of the leading service centres for the on-demand production of sand moulds for metal castings, and offers the VX4000 high-performance printer that can print sand moulds with a size of up to 4 x 2 x 1 metres. "In particular, companies such as ours, which manufacture many prototypes and small series, can derive tremendous benefits from the possibilities offered by 3D printing in terms of quality and time," says Nijhuis development engineer Luke Vrielink.

The conventional manufacture of the prototype requires three to four months from the drawing to the processed casting. Generally, the production of the wooden model can easily take two to three months, and then another few days to make the sand mould. This is not the case for 3D printing: Throughput times are significantly shorter. The information is e-mailed to voxeljet's order department the minute the CAD design has been completed. Based on the 3D CAD data, a high-performance printer at voxeljet's service centre produces the moulds without tools and on a fully automated basis using the layer building method. This does away with the cumbersome and expensive route of using the required moulding system. It is also possible to generate complex geometries with undercuts that are true to detail and highly precise. Depending on the size of the piece, the printing process will take one to two days.

Prototypes in record time

Throughput times for the printed sand moulds are significantly shorter. The information is e-mailed to voxeljet's printing department the minute the CAD design has been completed. Depending on the size of the piece, the printing process will take one to two days. Such short production times are especially important in the case of pump prototypes, as exemplified by the Nijhuis pump factory, which always develops and builds pumps made to measure. The 3D printing of the sand moulds allows the pump manufacturer to reduce the number of casting moulds in storage and still deliver more quickly if a part of a pump must be replaced on board of a ship, for example. Each day in the dock costs a lot of money. "The fact that we can now have the large sand moulds printed at voxeljet at a reasonable cost means that we are able to ship quickly even if the model is not in stock," says Luke Vrielink.

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The development engineer also sees a significant advantage in the higher quality. The 3D print corresponds 1:1 with the computer model, while hand-crafted products can always result in small variances. The more complicated the shape of the pump wheel, the higher the savings for printing in this production process. A good example is the screw-centrifugal wheel, a tapered wheel that must correspond exactly with the model. The shape of this wheel must be very precise, so as to avoid imbalances. Nevertheless, we have to polish the castings afterwards to remove any existing imbalances. Occasionally, castings must be polished for more than one day at the chip removal department of the Nijhuis pump factory. Sand printing takes care of the imbalances during the draft phase in the computer. The casting is much more precise and requires much less follow-up work.

Fine quartz sand for smooth surfaces

Another advantage of using voxeljet printing technology is the use of fine quartz sand. Compared to hand-crafted sand moulds, these castings have a smoother surface. This is reflected in the lower energy consumption of the pump. "Moreover, a sand mould is printed for each wheel, while we use standard models and cast more excess. Excess casting material must be removed by machine, which costs time," says Luke Vrielink. In the case of castings made of hard materials, this may mean even longer follow-up work. This is not the case for 3D processes: Here, the effort required for machining the parts is restricted to a minimum due to smaller allowances.

At the development department, Luke Vrielink and his colleagues had already been looking for a 3D printing technology. However, until now such technology was unaffordable. But in recent years, particularly voxeljet has accelerated the development of this technology, and costs have been reduced significantly. "But if the part is more complex, sand printing represents an attractive alternative. Certainly for prototypes, individual pieces or small series," says Vrielink. In his view, 3D printing will replace some of the conventional production methods.

At the Nijhuis pump factory, the castings produced with sand moulds from voxeljet are installed into the pump and extensively tested on a separate test stand. But Luke Vrielink is convinced of their quality. "By using this technology, European foundries can significantly improve their competitive situation."

Advantages at a glance:

- + short throughput time (a few days)
- + less follow-up work since the castings are more precise
- + the sand mould corresponds 1:1 with the CAD design
- + does not require storage or maintenance of models
- + cost savings for prototypes, individual pieces and small series

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Picture caption:

Fig. 1 a/b: These sand moulds are printed directly from a CAD file.

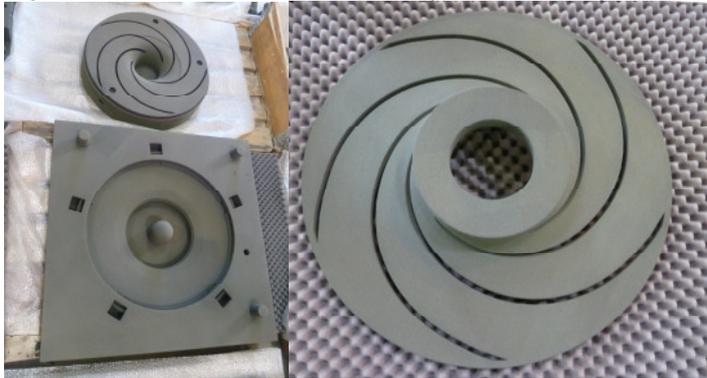


Fig. 2: Development engineer Luke Vrielink from Lihjuis in Winterswijk



Fig. 2: 3d-printer VX4000

