Care for Breasts

Developing Breast Prostheses via 3D Printing

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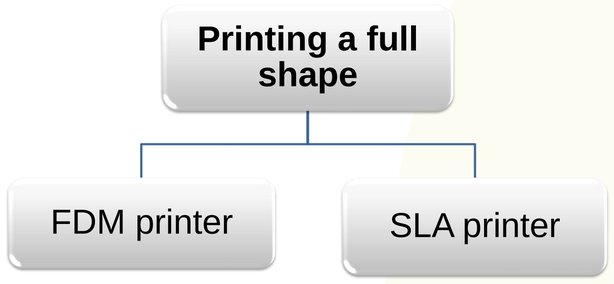
Company: Shap3d Up

Introduction

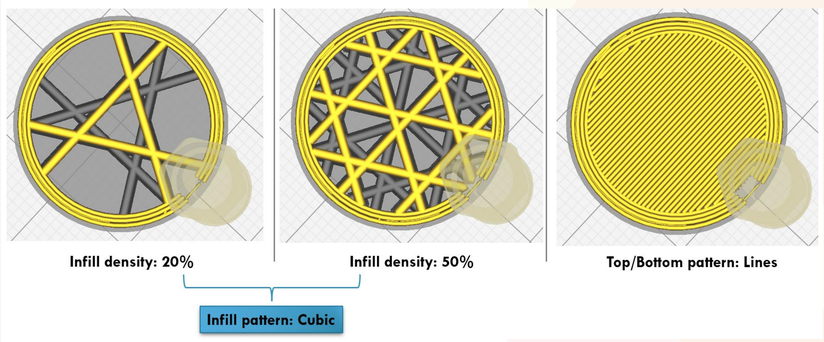
Monica Schlösser started to delve into external breast prostheses as she had breast cancer in 2015. It became clear to her that the current external breast prostheses that are available today do not meet the requirements from the market. She started the company Shap3d Up with help from Sjef van der Horst. Their idea is to produce a new kind of breast prosthesis via 3D printing. Aiming to realize this concept, they came to CHILL for help. A previous CfD defined several strategies to obtain the prosthesis. This project focuses on one of these strategies, i.e. to set up a method to directly print the breast prosthesis out of one type of material.

Materials and Methods

‘’What strategies can be used to develop breast prostheses with a 3D printer?’’



The chosen route was the printing a full shape out of one material using two different techniques: a Fused Deposition Modelling (FDM) printer and a Stereolithography (SLA) printer



One strategy to increase the softness is decrease the infill density.

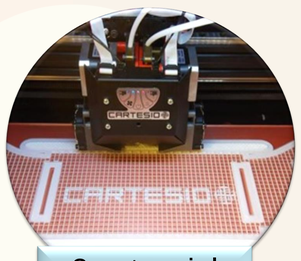
‘‘‘Which materials can be used to 3D print a full breast prosthesis that guarantee the needed properties?’’

There are some essential criteria that a breast prosthesis should meet:

- Softness;
- Flexibility;
- Breathability;
- Low density;
- Temperature regulation.

Three potential materials with different shore hardness (40A, 70A and 85A) and properties were used.

FDM printer

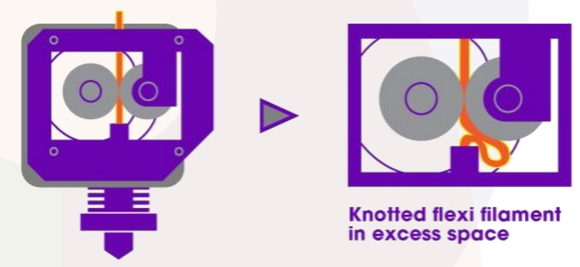


2 potencial materials

SLA printer

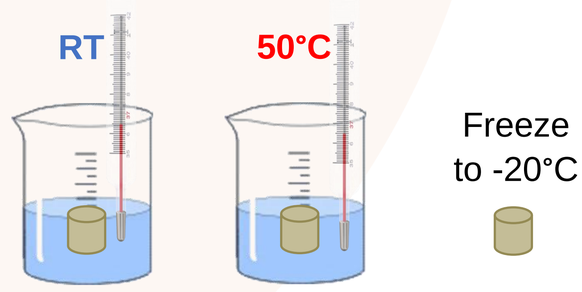
1 potencial material

Printing soft filaments: Why is this challenging?



Permeability Test

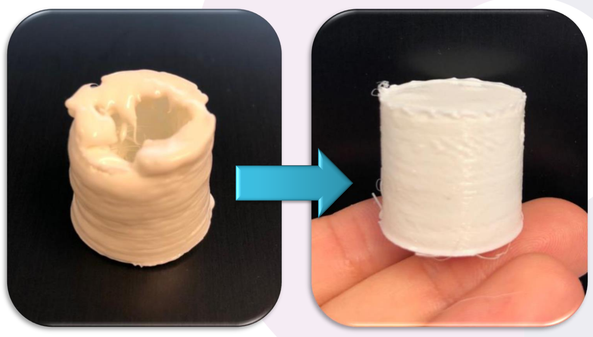
Simulate the possible temperature variations that the skin can suffer, depending on the climatic condition which was exposed.



Results

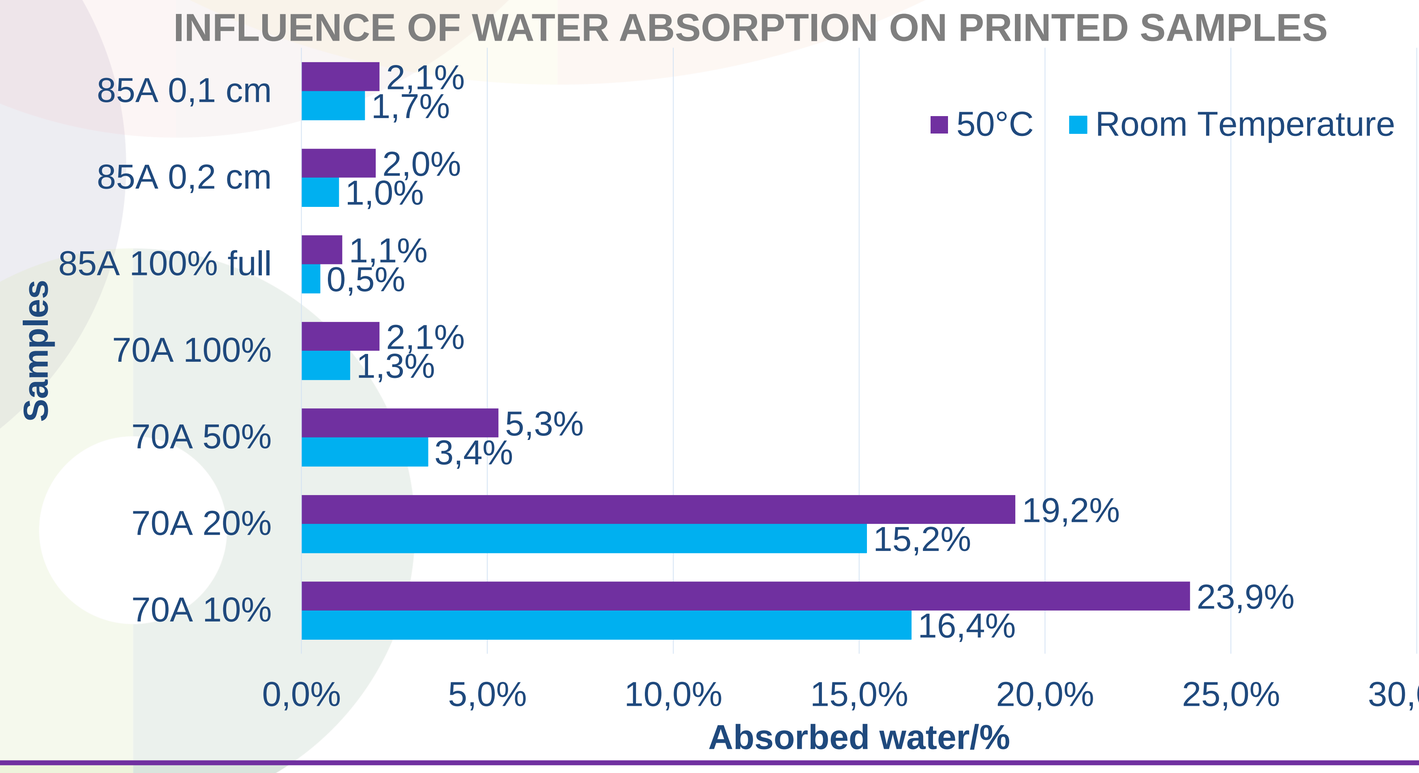
Printing settings

Material with shore hardness 70A:



Settings	Units	Values
Printing temperature	°C	185
Build plate temperature	°C	45
Fan speed	%	70
Print speed	mm/s	8
Outer wall speed	mm/s	10
Minimum layer time setting	sec	10

Permeability test



Conclusions

- Defined the best settings to print the materials and the biggest challenge was to improve the top coverage of the samples;
- The behavior of the materials 70A and 85A in contact with water was evaluated and in low temperatures (-20°C) no physical alteration was observed in the samples, neither water was absorbed for this condition. In the higher temperature (50°C) the both samples absorbed more water than at room temperature and just the material 85A became softer;
- The PVA-material (40A) is not a good option since the samples stay sticky because most likely not all PVA dissolved. So, after study the solubility was concluded that it is necessary more than the 4 days recommended in the literature to remove all the PVA and guarantee the softness and the rubber touch.

Next Steps: Perform compression test and print models of breast prostheses.

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