Case study: How QWarm and technical materials demonstrate their power with SnowWhite^2 thermal resistant components (part 1)

Fused Deposition Modeling Technology (FDM) works with specialized 3D printers and production-grade thermoplastic materials to build robust, durable and dimensional stable parts with the best precision and repeatability of any other 3D printing technology available. FDM is one of the additive production technologies widely used thanks to its potential to produce very complex geometries and clean post-process. The critical problems with this technology have been the balancing of the technical characteristics of the materials required by vertical industrial applications with the ability of the machine to process the selected material in the 3d printing process.

In this document we will analyze how we face off the engineering and cost saving problems with the application of **Sharebot Qwarm** FDM 3D printer, composite thermoplastic materials and design for manufacturing (design optimization for a specific production technology).

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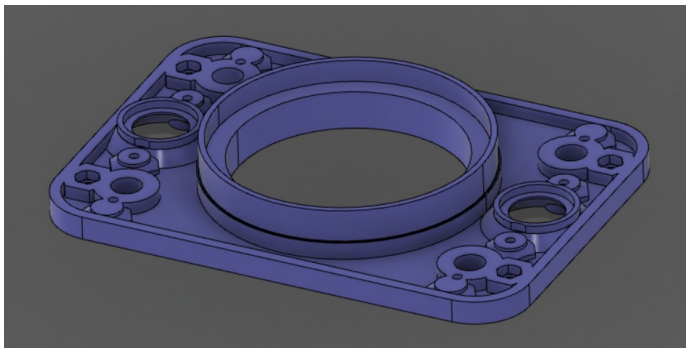
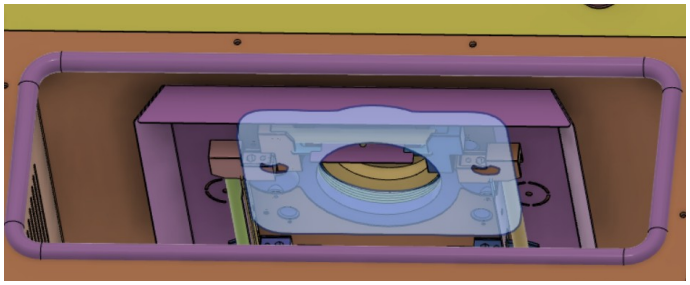
During the development of **SnowWhite2** (our 3D printer for polymer powder laser sintering) we encountered several problems on how to place heat sensitive components, such as the galvanometer laser head, the infrared temperature sensor and the webcam, all elements that we had to place very close the **SnowWhite2** printing chamber, which during the printing process reach temperatures above 180°C. The goals were to find a place for those parts without thermal stress in long-term use, using limited space and keeping the chamber isolated to reduce oxygen contamination during the printing process.

The first solution was to place all those parts behind a large window to separate the chamber environment from the external environment and ventilate the external environment in which the components were placed. Unfortunately this option was rejected due to the very high cost of the ZnSe glass (ZnSe glass is a specific coated glass used because it is highly permeable to the wavelength of the Co2 laser, 10600 nm)

So we decide to design a plate, made of PEEK-HTC (Peek Carbon Fiber), in which we were able to position the different components behind multiple smaller windows.



The plate was designed to be produced by the FDM printer without a support structure, it is fixed on the **SnowWhite2** frame. The plate support acts as thermal insulator, isolating the internal components of the chamber and reducing the transmission of heat from the frame of the 3d printer to the thermal sensitive components.



The plate is in direct contact with the internal environment of the chamber and does not suffer long thermal exposure to the chamber temperature.

The PEEK-HTC plate is fixed with a silicone gasket to the frame in order to reduce gas leakage.

The PEEK-HTC is a very stable material, with a heat deflection temperature of 320°C and a tensile strength of 180MPa.

Q Warm is able to print this plate in less than 20 hours and using 123 grams of material.

Giving the particularity of the material we print only one plate plus another component once a time, using the following settings:

-Borosilicate glass with Magigoo HT primer

-Raft

-40% infill

-4 shells

-5 top and 5 bottom

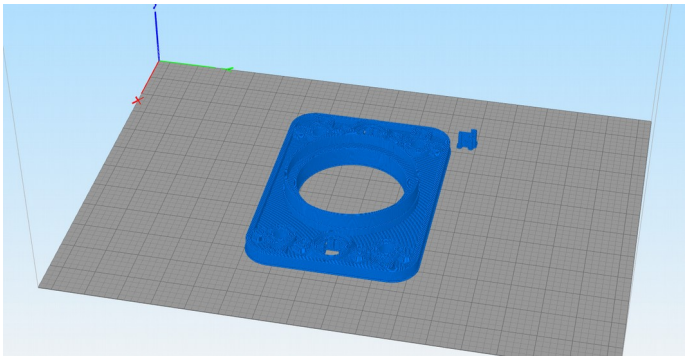
-Chamber internal temperature: 80°C

-Print bed temperature: 160°C

-Extruder Temperature: 380°C

-Printing Speed: 1050 mm/min.

The extruder is water-cooled and uses a 0.4 mm tungsten carbide nozzle to resist abrasion of the carbon fiber compound present in the filament.



The PEEK-HTC is a very specific and technical material, for other parts of **SnowWhite2** we opted for less expensive materials.

For example we use F1 RACE (PPS Carbon Fiber) for the insulated cover between the two glasses of the **SnowWhite2** door, where the material is still exposed to high temperatures but not directly in contact with the chamber. F1 RACE has similar characteristics to PEEK-HTC, but it is much easier to print and cheaper. F1 RACE have a thermal distortion temperature of 254°C and a tensile strength of 135 MPa. Sharebot Q Warm is able to print this material without restrictions, with full plate, using:

-Borosilicate glass with Magigoo HT primer

-Raft

-40% infill

-4 shells

-5 top and 5 bottom

-Chamber internal temperature: 80°C

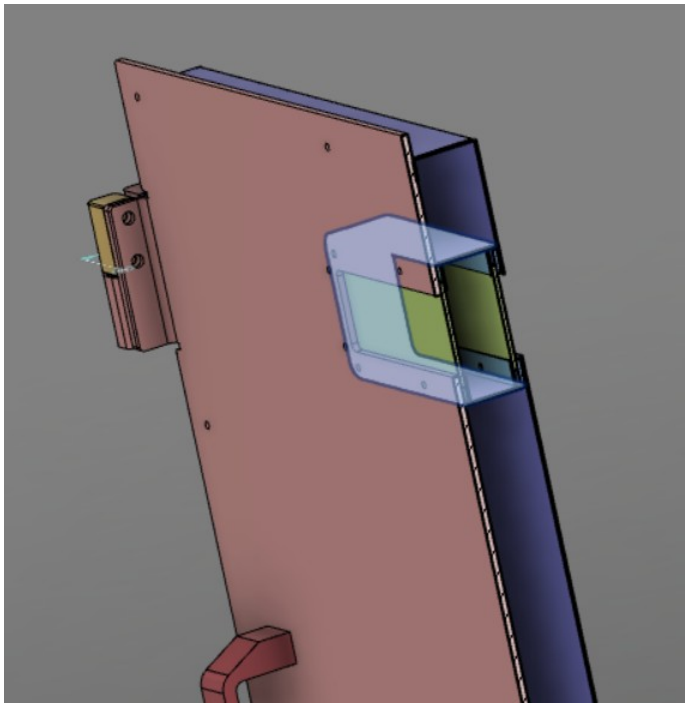
-Print bed temperature: 100°C

-Extruder temperature: 300°C

-Printing Speed: 1500 mm/min.

We decide to produce many other components, that works at lower temperatures, directly in additive manufacturing, that we will describe in next article.

(Part 2) How with Qwarm we perform the production of several parts for SnowWhite2



Stay Tuned!

Sharebot R&D Team

For any question please ask to info @ sharebot.it