Project „MyBreathMask“ – Respirators with the highest level of comfort and safety

Report: Jürgen Leßlhumer

Initiated by HARATECH GmbH, several Austrian partners are working on the development of modular and customizable FFP2-3 respirator masks.
In the project, Wood K plus is responsible for the selection of materials and the additivation of the polymers.

The corona pandemic has changed a lot, for instance wearing a mouth and nose protection and FFP2 mask has almost become routine or is accepted in order to be able to / be allowed to do things of everyday life (e.g. shopping). The currently common foldable FFP2 masks are not really comfortable and not sufficiently safe. When talking, a face is often worth a thousand words. Due to the mostly non-transparent masks, the facial expression is completely lost. There are already a few transparent solutions available on the market (fig. 1). But these are very often made of silicone, not recyclable and mostly very expensive.

Figure 1: LEAF mask (© www.leaf.healthcare)

Therefore, an Austrian consortium is targeting a development of a revolutionary respirator that does not have any of the deficits mentioned. The project "MyBreathMask" is being carried out as part of the FFG Emergency Call for research into COVID-19 in response to the Sars-CoV-2 outbreak (KLIPHA-COVID19) (FFG project-no.: 881620). The project is led by HARATECH GmbH, an established system supplier for series production and special solutions. HARATECH is responsible for the design and construction of the modular mask (fig. 2) and the selection of the filter. Furthermore, they are accountable for the material testing in injection molding with a rapid tooling mold, the FFP2-3 certification as well as the subsequent automated injection molding production.

Figure 2: CAD rendering of the current design and a first prototype (© HARATECH)

In terms of standardization (especially ÖNORM EN 149) and certification, HARATECH is supported by the Austrian Institute of Technology (AIT). Wood K plus was assigned to select ecological materials and suitable additives. The comprehensive specification includes attributes such as "transparent", "elastic", "70 Shore A", "skin-friendly", "food-safe", "UV-stable", "chemical- and hot water-resistant", "recyclable" and "bio-based". After intensive research and numerous discussions with material producers as well as suppliers, different thermoplastic elastomers (TPE) were chosen. These polymers behave like classic elastomers at room temperature, but can be plastically deformed when heat is applied. UV stabilizers were used to improve the weather resistance. As an additional function, the selected thermoplastic elastomers should have an antimicrobial or antiviral effect. For this purpose, antimicrobial additives that act against gram-positive and gram-negative bacteria are tested. To select suitable materials, different TPEs were sampled in injection molding and the transparency was assessed. Furthermore, an artificial weathering test was conducted in order to investigate the influence of harmful UV radiation (fig. 3).

Figure 3: Considerable yellowing after artificial weathering in xenon test chamber (© Wood K plus)

One other issue in the project is coating. On the outside, the respirator should be antimicrobial and easy to clean, while a coating inside should prevent fogging from exhaled air. Furthermore, it is essential to maintain transparency. The coating is the area of responsibility of the JOANNEUM RESEARCH Forschungsgesellschaft mbH.

A disadvantage of current respirators is that they are often only available in one size fits all and that they only partially adapt to the shape of the face. As a result, people avoid wearing the masks whenever it is possible and the protective effect against airborne transmission is minimized.

This point should be solved by a personalization of the developed mask. The aim is to set up a semi-automated construction interface between face scans, modular mask design and 3D printing for person-specific adaptation. Mr. Martin Knecht (wainobi) and Mr. Thomas Auzinger from the Institute of Science and Technology Austria (IST Austria) are responsible for the personalization. For this purpose, an iPhone face scan app is being developed. The 3D data of the mask are placed over the face of the user (red lines) and projected onto the face geometry (blue lines). Depending on the position of the mask, the curves have to be adjusted (fig. 4).

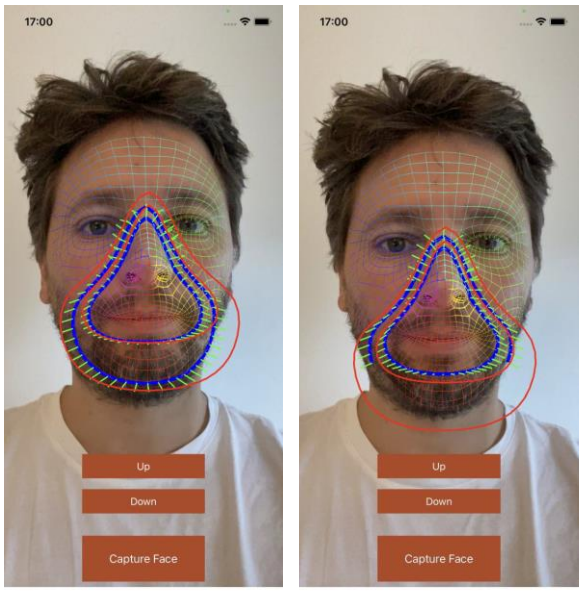

Figure 4: Screenshots (© Martin Knecht)

It can happen that the mask outline is underneath the facial mesh (fig. 5, left). Then it is necessary to complete the curve using the depth data available from the camera image (fig. 5, right).

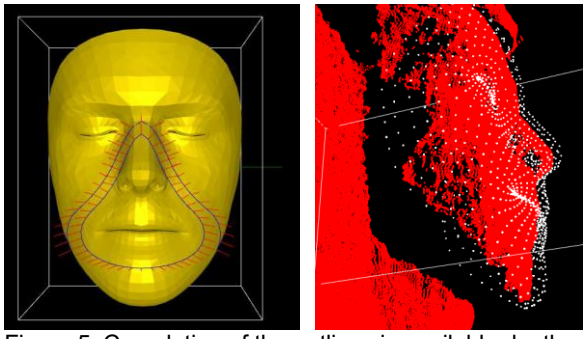

Figure 5: Completion of the outline via available depth data (© Martin Knecht & IST Austria)

The certification phase and tool implementation has just been started.