

## Multifunction 3D printing on textiles

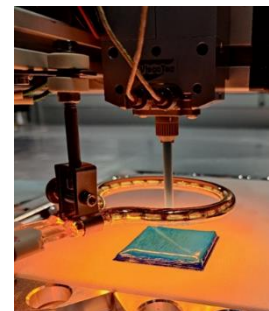
### Motivation

By applying 3D printing to functionalise textiles, various extrusion processes with small single nozzles are applied. With this technology only one material at the same time could be processed while manufacturing. If more than one material is required, machines with two or more printing nozzles are used or the material has to be replaced in between. The result is loss of time due to setup times, while at the same time there is no possibility of grading the properties.

The aim of the project was to generate at least three functional modifications, e.g. different degrees of surface hardness of a printed structure on a textile. To achieve this, it was necessary to develop a 3D printing process for textiles in which different functions were set within one print pattern by software. During the manufacturing process, two different materials were applied onto the textile substrate via a variably adjustable mixing ratio. So, it is possible to give the textiles the desired functional properties exactly where they were needed according to the requirements.

### Experimental

The project is focused on a two-component (2K) print head that enables the supply of two different viscous materials which were mixed together in a static mixing tube with variable ratios. With the aid of the 2K print head and an adapted slicer software, a 3D printing process for textiles was developed for generating at least three functional modifications. The functional modifications in gradients were generated by adjustment of the mixing ratio of two viscous materials while the printing process. These materials were water-based polyurethane dispersions modified with rheological and dispersing additives as well as functional materials. The main achievements were an increased abrasion resistance, gradual hydrophobication, optical effects, variable surface hardness and antibacterial effectiveness.

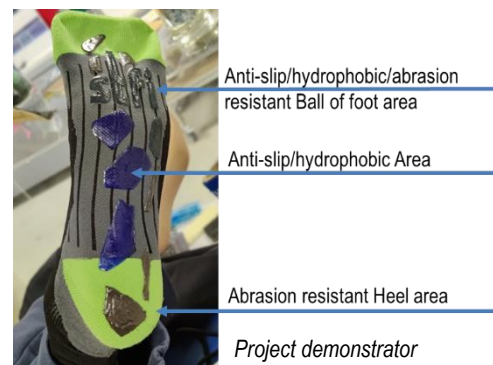


3D printing process on textile using 2K print head

### Results

During the project machinery as well as software was modified to achieve an online mixing in variable ratios of two different inks while the printing process. With the help of the developed functional viscous materials, a wide variety of print samples were produced, and the 3D printing process using this 2K print head was successfully developed. The operation of the respective functional properties was successfully demonstrated in the corresponding test procedures. At the end of the research work, the 3D printing process was used to produce printed sock and glove samples that were equipped with several functional modifications in a single process step.

This process thus represents a resource-efficient alternative to conventional methods (e.g. screen printing). At the same time, it favours the continuing trend towards customised production.



### Acknowledgement

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