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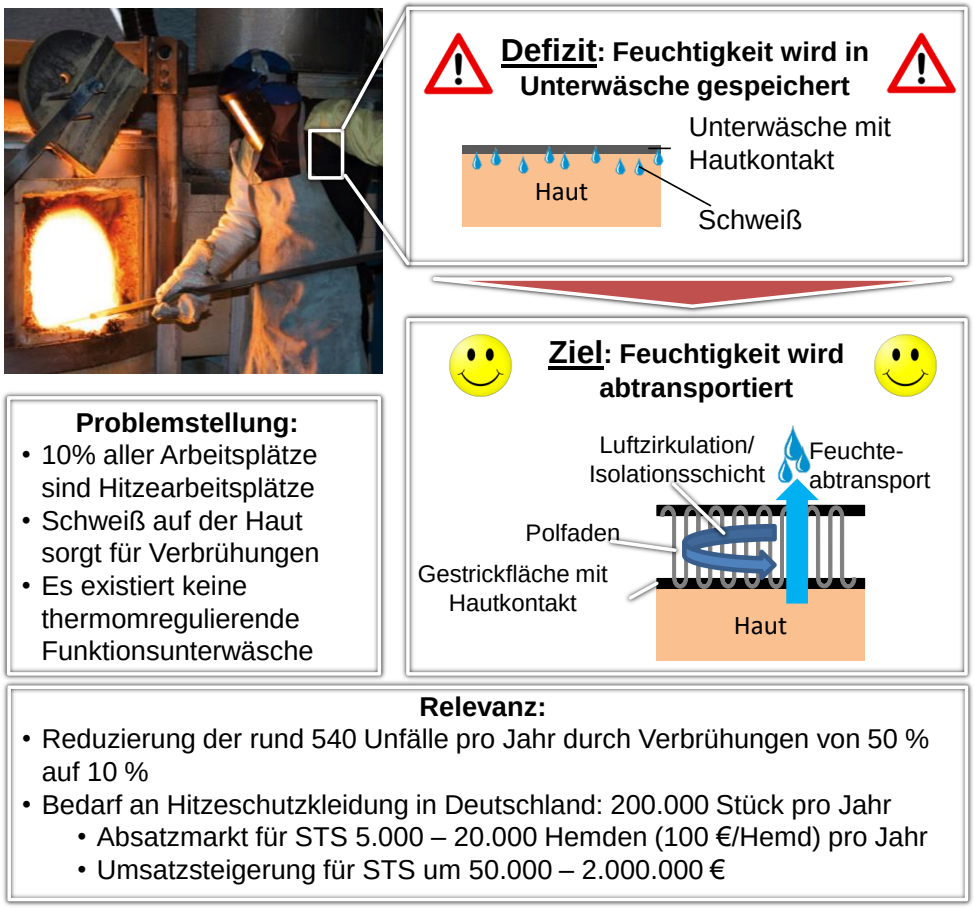
Project title:	Development of heat-exposed occupational safety textiles (HEATex)
Partner:	STS Textiles GmbH & Co. KG, Grünbach
Running time:	04/2017-03/2019
Conveyor carrier:	ZIM

Central image of the ZIM project HEATex



Issue

In many areas of application (blast furnaces, forges, foundries, fire brigades), employees are exposed to high temperatures. Due to increased ambient temperature and/or strong physical exertion, the body temperature heats up (regular 37°C±0.5°C) and a life-threatening heat shock can occur. Protective clothing can counteract this. The focus in the development of heat-protective clothing is usually on the outer layers. However, it becomes problematic in the deeper layers. Below the outer layer, which protects against radiation and burns, conventional cotton underwear is often worn. The underwear lying directly on the surface of the skin absorbs the mois-

ture from the body and the external heating causes scalding and overheating due to the body's own perspiration. Especially in pressure-loaded areas, injuries occur because the air circulation is obstructed. If the material is pressed together, direct body contact of underwear and skin occurs, moisture is prevented from being transported away and scalding occurs.

Goal and Approach

The aim of the research project is therefore to produce long-sleeved underwear (outerwear and underwear) for heat-exposed workplaces. By using a specifically designed and developed three-dimensional textile, this new type of underwear protects against scalding and overheating in direct skin contact, especially in pressurized areas. In addition, the underwear supports the removal of moisture from the skin.

Economic significance & benefits

In Germany, around ten percent of the working population are exposed to high temperatures at their workplace (metal, glass, ceramics and chemical production and food processing). The voluntary fire brigade with 1.2 million members alone currently uses conventional underwear during operations. Every year, 540 accidents of firefighters occur in Germany with serious injuries, including death. The proportion of injuries caused by overheating is 50%. The new climate-regulating underwear is intended to reduce the number of injuries caused by scalding in heat-exposed industries from 50% to 10%. To date, there is no functional underwear that specifically directs moisture away from the body and protects against pressure. The underwear can be used in all areas exposed to heat. In addition to protecting against injuries, the garments increase the feeling of comfort at hot workplaces. The total demand for heat-protective clothing in industry is 200,000 pieces per year. Relative to the whole of Europe, it even amounts to more than 1 million pieces of clothing per year.

Solution:

Within the scope of the project, functionalized heat protection underwear made of three-dimensional textiles will be developed, designed, produced and tested. The underwear supports the removal of moisture in order to protect against scalding, especially under pressure. The underwear is realized by a new spacer fabric. Spacer knits consist of two parallel layers, which are kept at a distance by a third thread layer (pile threads, mostly rigid monofilaments) (Figure 1). The inclusion of air between these layers creates an insulating layer. In order to counteract scalding, this insulation layer must be kept upright during the entire application. In highly stressed

areas (knees, elbows, shoulders, back) stiffer pile yarns must therefore be used to keep the distance. There is currently no possibility of changing the stiffness of the pile yarn during the running process.

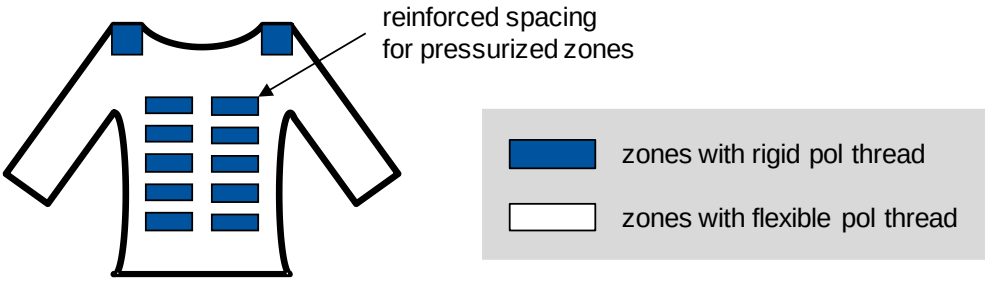


Figure 1: Modification of the pile material to create pressure-resistant zones in heat-protective underwear

Within the scope of the project, an additional thermal splicer unit will be produced, which allows to change the pile yarn during the running process and thus to adjust the distance stiffness of the structure (Figure 2). The challenge with this splicer unit is to ensure the perfect knitting process. Ensuring the knitting process involves, on the one hand, connecting different pile yarns in a fraction of a second so that yarn breaks do not occur. On the other hand, this concerns the timing of the change with the machine. The thread inlet quantity and patterning must be matched to each other.

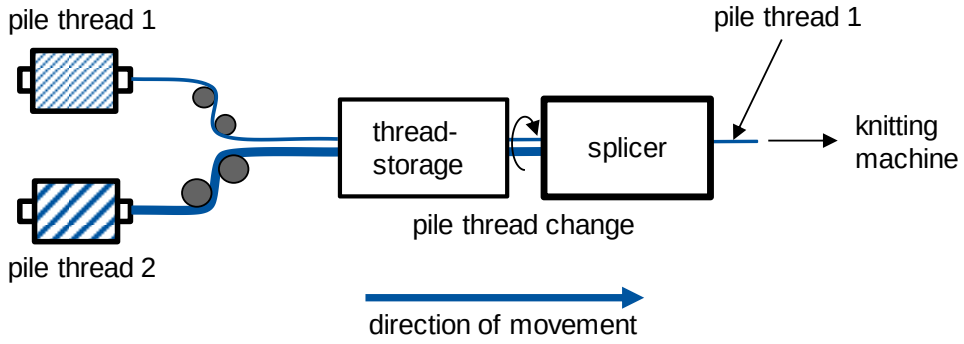


Figure 2: Principle sketch of the Splicer System

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