

Project title: Recyclable safety shoe components without end of life (laufSohLe)

Partner: Scherfdesign concept & development GmbH & Co. KG, Viethen (associated company: Airconcept GmbH)

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Mission Statement

Every year, 40 million pairs of safety footwear are manufactured in the European Union, with approximately 10.5-11.5 million pairs manufactured in Germany alone. Safety components such as puncture-resistant insoles and toe caps are generally not recyclable or separable. 80% of shoes are directly soldered on and the sole is pinched with a GFRP or steel toe cap. This results in a lot of hazardous waste annually. In addition, the puncture-resistant sole has so far only been tested in accordance with DIN 20344 with a rounded test piece (pin, or 1mm ball). These soles cannot prevent the penetration of sharp objects such as nails. The toe caps are currently made of steel (1.8mm), aluminum (2.5 mm) or GRP (8 mm). This not only limits the comfort of the shoes, but also the design freedom, since the material is too heavy on the one hand (steel) and on the other hand the necessary residual height after the drop test can only be achieved with a high material thickness (GRP).

shoe concept with removal option for recirculation



puncture-resistant sole with increased protection and cushioning

lightweight toe cap with reduced wall thickness

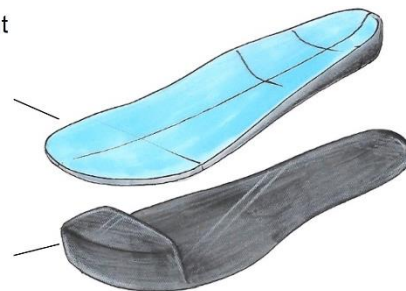


Figure 1: concept and demonstration shoe

The aim of the proposed research project is therefore to develop reusable anti-puncture soles and toe caps that can be removed and reused after the shoes have been worn for the maximum period. Thus, the central innovative character of the intended project lies in the first-time development of a shoe concept with a removal option for the safety components. The approach

to achieving this goal is an innovative redesign of the safety shoe construction in order to achieve the overriding goal of reusability and improved separability of the individual components of the shoe.

Approach

Bionic approaches are used for this purpose, since numerous biological models already exist for the circulation capability and fiber-friendly design. These include the structure of the leg of the mantis shrimp, which can serve as a template for depositing fibers. This ensures that not only the technical requirements are met, but also that resources are used in the best possible way, which is a further contribution of the project to increasing sustainability. The DIN 20344 test methods used to date to approve safety footwear are not aimed at testing used safety components. Low-threshold and non-destructive testing methods are being developed to check used soles and caps and to ensure reusability. In addition, concepts for recycling are being developed in compliance with the necessary EU type examination for PPE. For the safety components sole and toe cap, an innovative product concept is aimed at, in which the GRP/steel is substituted by lightweight materials (e.g. combination of carbon, glass fiber, aluminum and bio-resins). This not only increases the service life and durability of the safety components, but also offers greater design freedom and better protection of the puncture-resistant sole against penetration by sharp objects (e.g. nails). In addition, the comfort of the sole and cap is to be improved with the aid of increased cushioning and energy absorption. This is accompanied by a thinner wall thickness and a lower weight of the safety shoes, which further increase comfort.

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