



Seed Funding Global South 2023 – Project report

Additive manufacturing of novel bi-layered hydrogel based shoe insoles

- Chair at the TU Berlin: Advanced Ceramic Materials
- Partner country/countries: Pakistan
- **Partner institution (s):** Interdisciplinary Research Centre in Biomedical Materials (IRCBM), COMSATS University Islamabad Lahore Campus, Pakistan
- Sustainable Development Goals (SDGs):



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- SDG 3: Good health and well-being
- SDG 5: Gender equality
- SDG 9: Industry, Innovation and Infrastructure

The cases of diabetes are growing worldwide. The rate of diabetes incidence is highest in countries of the Global South. Diabetes, rheumatoid arthritis and the associated complications are a challenge for patients and healthcare systems. About 33% of these diabetic patients also suffer from the pathologies related to their feet (diabetic foot ulcers). In diabetic patients the main reason for these foot ulcers are thermal trauma and multiple mechanical trauma, which cause high mechanical stress. Although almost 50% of the cases of the foot ulcers are healed, however a significant number of the foot ulcers remain active and ultimately lead to amputation in the limb. So several traditional treatments and medications are not effective. One solution for these patients could be the use of shoes with customised multifunctional insoles.

In collaboration with our Global South partner - Interdisciplinary Research Centre in Biomedical Materials (IRCBM), COMSATS University Islamabad Lahore Campus, Pakistan - we as a chair of Advanced Ceramic Materials at TU Berlin developed a 3D-printing technology to produce customized novel insoles to rehabilitate musculoskeletal deformities such as flatfoot and diseases such as diabetic foot ulcers. This joined project led to very promising results and further ideas. In this approach we established a short and economical customized fabrication process which includes two-step 3D-printing to produce a bi-layer foot insoles with extraordinary visco-elastic and regenerative properties.

The Seed Funding program gave opportunity to both partners for scientific exchange visits. At first the collaborator of the Global-South partner Institute Dr. Asma Tufail visited TU Berlin in August 2023. During her visit she got a training on our customized 3D-printers in our chair at





TUB. Later on, in November 2023, Dr. Oliver Goerke from TU Berlin visited the partner institute in Pakistan, where he gave training to young scientists to prepare a composite hydrogel.

We achieved a proof of concept of insoles after working on all processing steps in both partner institutes.

Our project addresses the following SDGs:

3 – GOOD HEALTH AND WELL-BEING: This project focuses on health treatment, especially in the Global South, where the tragic consequences of diabetes and rheumatism are very prominent and lead to serious outcomes.

5 – GENDER EQUALITY: The project emphasises on health, irrespective of gender (women are affected preferentially), hence, it is beneficial for all genders and ethnicities.

9 – INDUSTRY, INNOVATION AND INFRASTRUCTURE: The project idea is based on a translational approach with a focus on commercialization and hence will be valuable for industries in the future.