TECHNISCHE UNIVERSITÄT DRESDEN

ITM LEADING IN FIBRE & TEXTILE TECHNOLOGY
The Research Institute of University of Excellence

Faculty of Mechanical Science and Engineering Institute of Textile Machinery and High Performance Material Technology

Textile Welding – Application, Process investigation, Quality Assurance and Control

Introduction

Alternative thermal joining technologies, like ultrasonic (US) and high frequency (HF) welding for the bonding of flexible materials are becoming more important for industrial applications. By using these technologies, the seams of functional textiles, high-performance reinforcement textiles, and film materials can be equipped with additional functions which are beyond the property profile of the original fabric. Several interdisciplinary research projects at the Chair of Assembly Technologies for textile Products focus on the US welding and HF welding technologies. This poster presents some results of multiple projects.

Inline monitoring for nondestructive testing of ultrasonic welded seams[1]

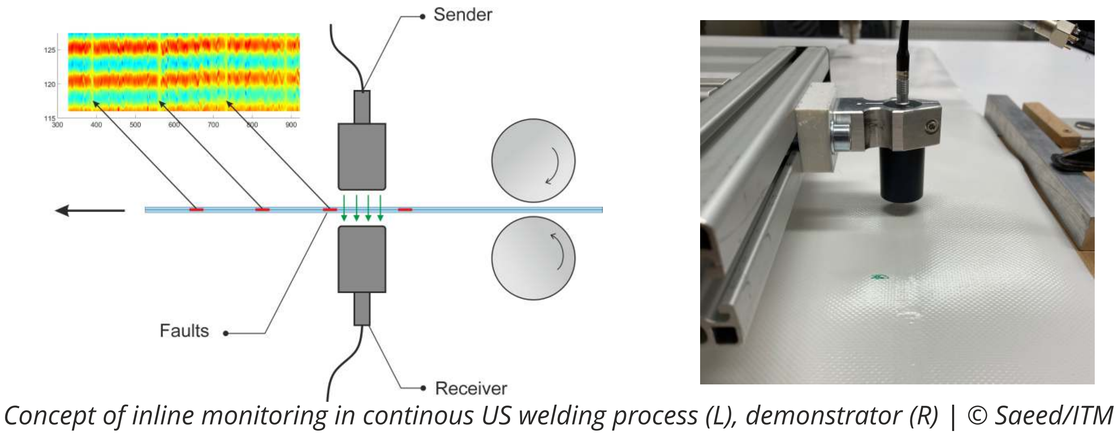
Objectives

The objective of the study is to develop an inline, nondestructive testing method for the quality control of welded seams during continuous ultrasonic welding process. Currently, the quality control of US seams are perfomed on the basis of sampling standards, and the quality control of complete welded seam is not ensured.

Methods/results

Air-coupled ultrasonic sensors were used to detect defects in the welded seams. Studies were performed to identify the most suitable working frequency and optimization of ultrasonic sensors. A demonstrator was integrated with an ultrasonic welding machine and the tests were performed in a continuous US welding process.

- Self-created faults (5 mm-1 mm in width) were introduced in the welded seams.
- Very good reproducibility of results is achieved for faults of 5 mm - 3 mm.
- Faults of 2 mm and 1 mm were also identified. However, further investigations are required for more reproducible results.



Concept of inline monitoring in continous US welding process (L), demonstrator (R) | © Saeed/ITM

Development of thermoactive indoor heating and cooling systems[2]

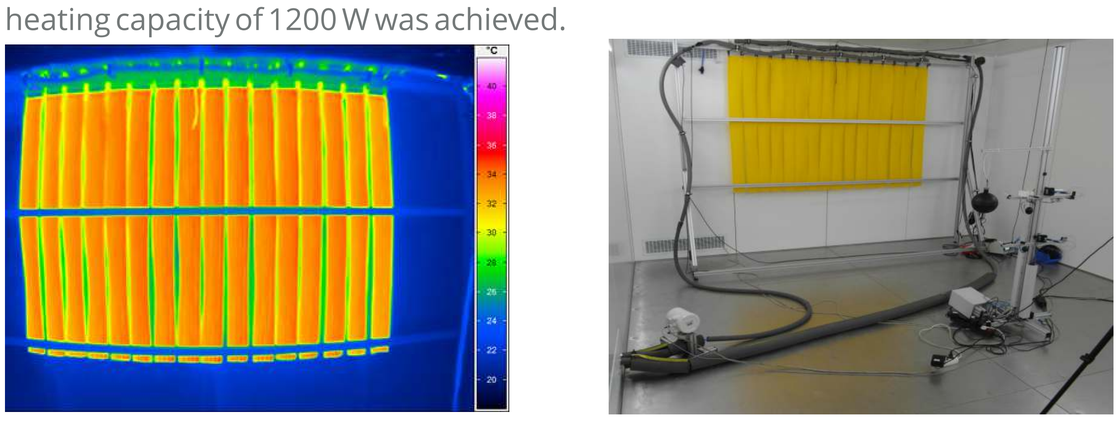
Objectives

To ensure comfort in living and working spaces, heating or air conditioning systems are necessary. A possible solution is the textile-based temperature control system, which can be flexibly integrated into existing rooms and building structures as an alternative to the inflexible conventional temperature control systems.

Methods/results

Ultrasonic welding technology is used to firmly bond polyurethane coated thermoplastic textile materials, which shows the most acceptable properties for textile-based temperature control systems of rooms. The heating /cooling media (water) flows through channels that are created in the textile structure, bonded together by ultrasonic welding technology.

Another advantage of this solution is that it can be easily integrated with the existing media supply of conventional building temperature control systems and only minor changes are required. The experiments were performed on thermal room textiles in the form of a window curtain. A cooling capacity of 700 W and a heating capacity of 1200 W was achieved.



Thermographic image of curtain (L) experimental arrangement in climate room (R) | © Reich/ITM

InSitu monitoring of joint areas of textile membrane structures[3]

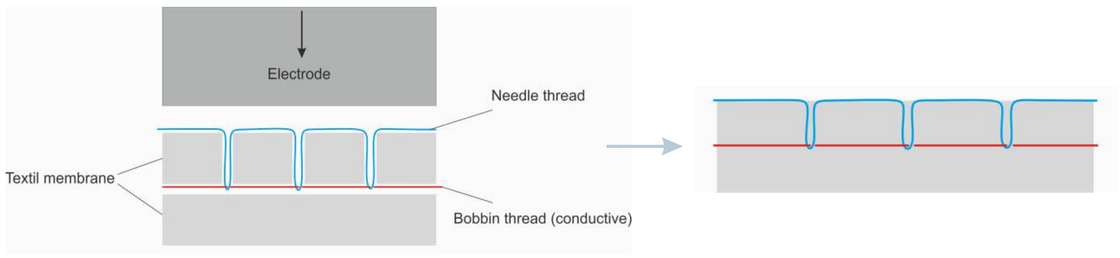
Objectives

Complex dynamic loads are involved in typical usage scenarios for load-bearing components of the textile architecture. Most structural failures occur in/around the welded zones. An InSitu measurement system is developed to monitor load information of welded seams areas in real-time.

Methods/results

Conductive sewing threads were used to carry signals under realistic load conditions. They were stitched into the welding zone by lockstitch principle and later the membranes were joined with high-frequency welding technology. Different sensor thread layouts were experimented to get the best results. Numerical modeling and simulation of membrane joints were also performed.

- The sensors can be integrated into the high-frequency welding process and generate reproducible sensor signals under strain.
- The functionality of the sensor yarn was proven during shear testing of the welded seam with integrated sensor yarns in the welding zone.



HF welding with conductive sewing thread (L) finished seam with integrated sensor | © Saeed/ITM

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