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Adhesion analysis on a soft composite material membrane

Ultrasonic welding of a PU-PVC Fabric

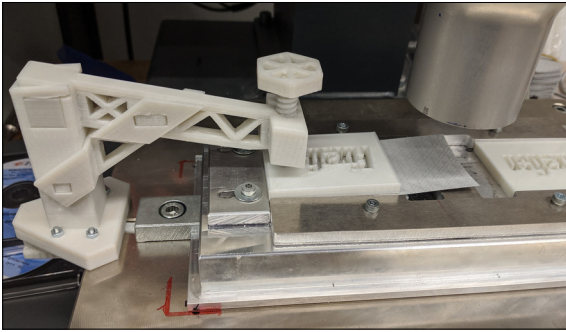


Figure 1: Positioning and fixation of the workpieces on the ultrasonic welding unit
Own presentation

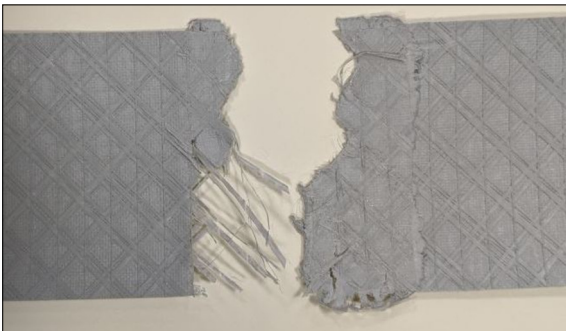


Figure 2: Fracture pattern of a tensile shear strength testing
Own presentation

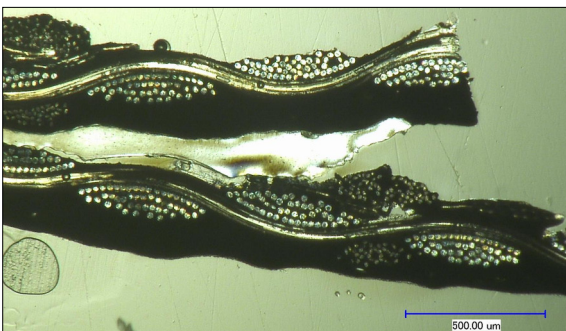


Figure 3: Structure analysis of a PU/PVC centre seam
Own presentation

Problem: Technical textiles for shading are mostly sewn nowadays. Sewing technical textiles has some disadvantages. While sewing the textile gets punctured, which affects the water resistance.

Textile processors often use ultrasonic welding units in their companies. In the context of this semester project the possibility of ultrasonic welding of the seam by using a hot melt adhesive between two foils of textile shall be investigated. Two seam types will be analysed a PU/PU edge seam and a PU/PVC center seam.

Approach: The study was conducted in three steps.

Firstly, pre-tests were done to analyze the influence of the different welding parameters on the quality of the PVC/PU seam and to determine an optimised parameters set for the following tests.

Secondly, different adhesive materials were tested during the welding process using a testing setup (Figure 1) in order to obtain a reproducible welded area. The mechanical properties of the PVC/PU welded samples were evaluated using tensile shear strength testing (Figure 2) and microscopic analysis (Figure 3). The most suitable adhesive materials were selected for further optimisation.

In a third test campaign, the influence of the adhesive thickness and energy directors has been investigated. The welding parameters were optimized in order to achieve the highest possible tensile shear strength.

Finally the results of the PVC/PU seam have been transferred to the PU/PU edge seam.

Result: During the third testcampaign, an adhesive thickness of 2 layers showed the best performance. The optimisation of the welding parameters finally led to an average tensile shear strength of 610 N/5cm for the PVC/PU center seam.

Finally the results of the PVC/PU seam have been transferred to the PU/PU edge seam. The same parameters and the same adhesive led to a tensile shear strength of 390N/5cm.

The reference tests with the ground material without seam showed a tensile strength almost twice as high as the results of the tests with the welded seam.

An exact adjustment of the welding machine is essential to achieve useful results.

The size of the joining surface has an essential influence on the welding parameters. The heat and friction initiated by the welding process, weakens the ground material and thereby reduces the tensile shear strength.