

Thermal and Mechanical Analysis of a Sustainable Alternative to Neoprene Wetsuits

Eric Holmström och Jakob Mattsson

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Oil-based neoprene is used today to create wetsuits that last only for a couple of seasons. A moulded sandwich structure has been found to be competitive as a sustainable replacement.

In the market research (figure 1) that was published in several different Swedish surfing forums it was clear that flexibility, durability and to some extent sustainability are of high priority when purchasing a wetsuit.

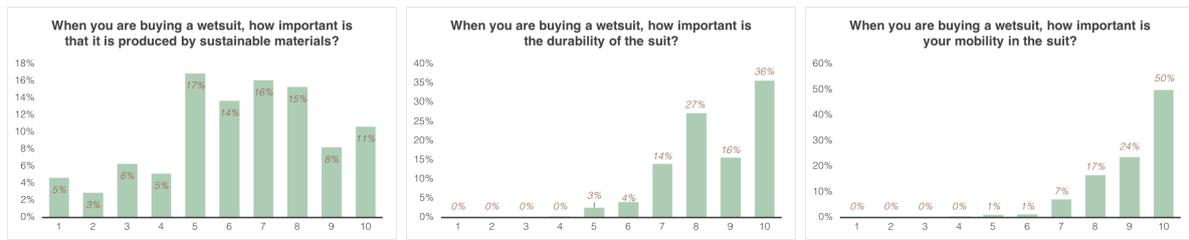


Figure 1: Answers from a survey published in Swedish water sport forums with 621 participants.

A sandwich structure with rubber layers containing an insulating fabric such as recycled cotton has been investigated and compared to today's wetsuits (figure 2), trying to achieve what was found in the market research.

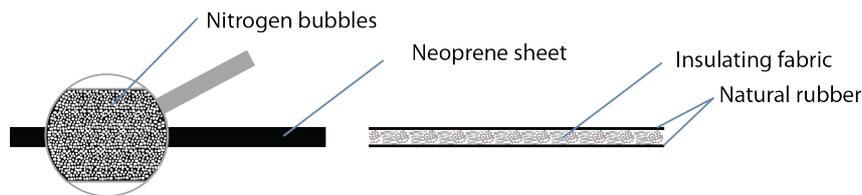


Figure 2: Today's wetsuit material (left) and the new sandwich structure (right).

This new material showed better insulation with around 33% compared to the oil-based neoprene that is used today. As a consequence this means the suit can be made thinner and more mobile to wear for the user.

In terms of elasticity, the sandwich structure was indeed elastic but not enough to outrun neoprene that was found to be even more flexible. This is believed to change with the use of another kind of natural rubber in the outer layers.

To produce the samples, a moulding process was used (figure 3) to create non-regular shapes. This way, a wetsuit without any seams from stitching can be made. Using natural rubber that has excellent durability and a structure without any seams, is believed to extend the lifetime of the wetsuit. This have to be further tested for confirmation.



Figure 3: Moulding process.

The moulding method can be used to create whatever shape that is needed. As a final test a wetsuit shoe was created, tested and compared to a wetsuit shoe on the market (figure 4). The self invented shoe test showed that the sandwich structure insulated approximately 48% better, meaning it can easier keep the athlete warm during cold and long sessions in the water.



Figure 4: Insulation test of two wetsuit shoes: sandich structure (left) and a neoprene shoe (right).

The results obtained in this thesis will be used to create a seamless wetsuit with superior insulation properties and most probably with increased durability as well. The process has been analysed to be more sustainable. However, from an economical point of view the sandwich structure is slightly more expensive to produce. On the other hand, the moulding process used to produce the sandwich structure is expected to be easier to automate and in that way costs can be reduced.

Future work includes using a more elastic rubber, testing durability and to make the process more cost efficient. Overall, the results in this thesis show that the sandwich structure has a great chance to outperform neoprene while reducing the impact on the environment.