

Aeroveil: The Future of Winter Jackets

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Introduction

The Aeroveil Project's goal is to create a lighter, thinner jacket for use by outdoor hobbyists such as skiers and hikers.

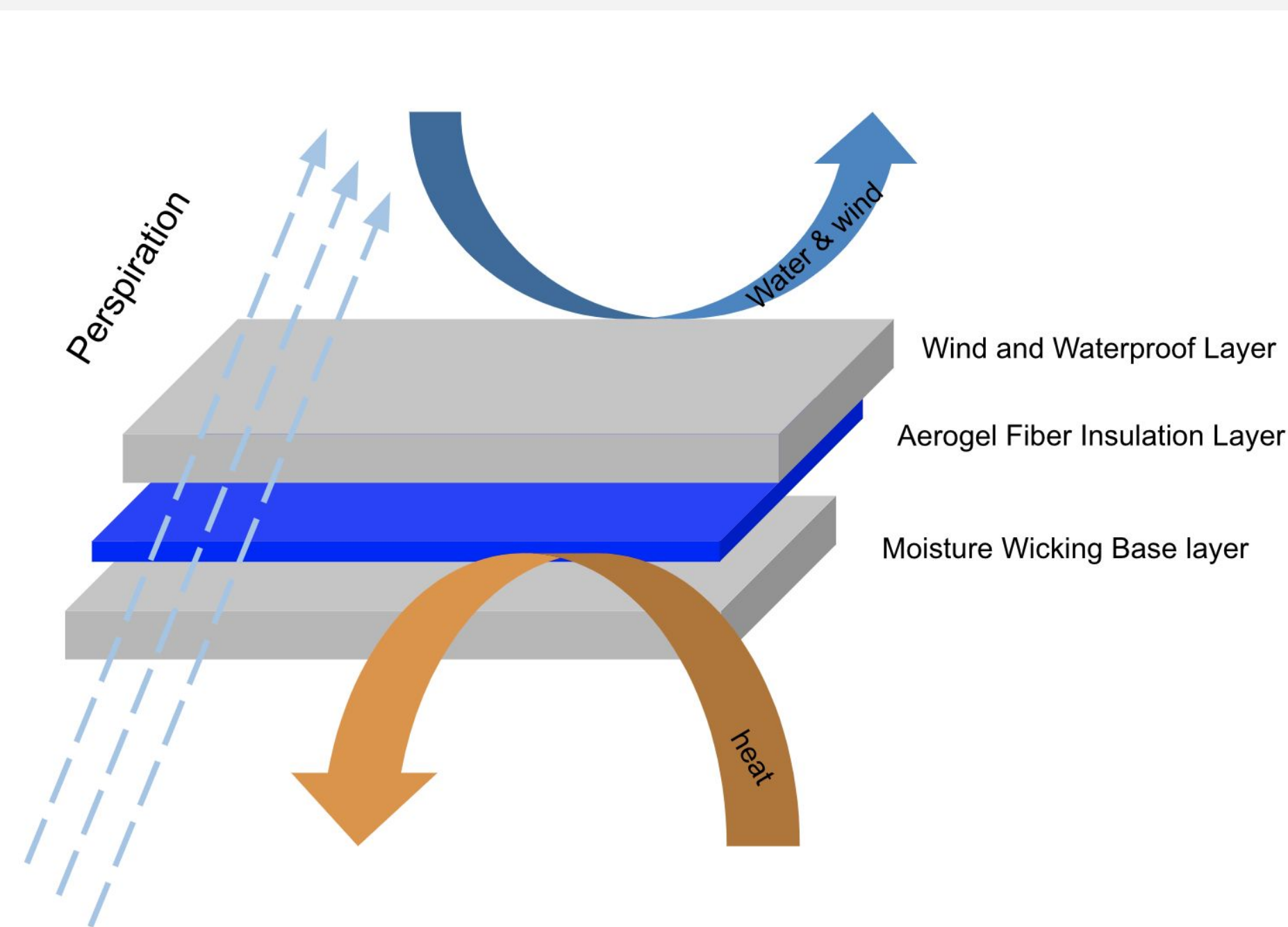
Traditional winter jackets are heavy and restrict movement. Outdoor hobbyists would benefit from something that keeps them warm, but also allows them quick, unhindered movements. This is where Aeroveil enters. Aeroveil is an aerogel-insulated jacket that is thin, at 2mm, and light, at 0.77kg.

The peak of aerogel-based jackets on the existing market, by AILIFE^[5], is identical in thickness, but weighs a full kilogram and is nearly double the price of our jacket at \$940.00. We provide a lighter, significantly cheaper alternative.

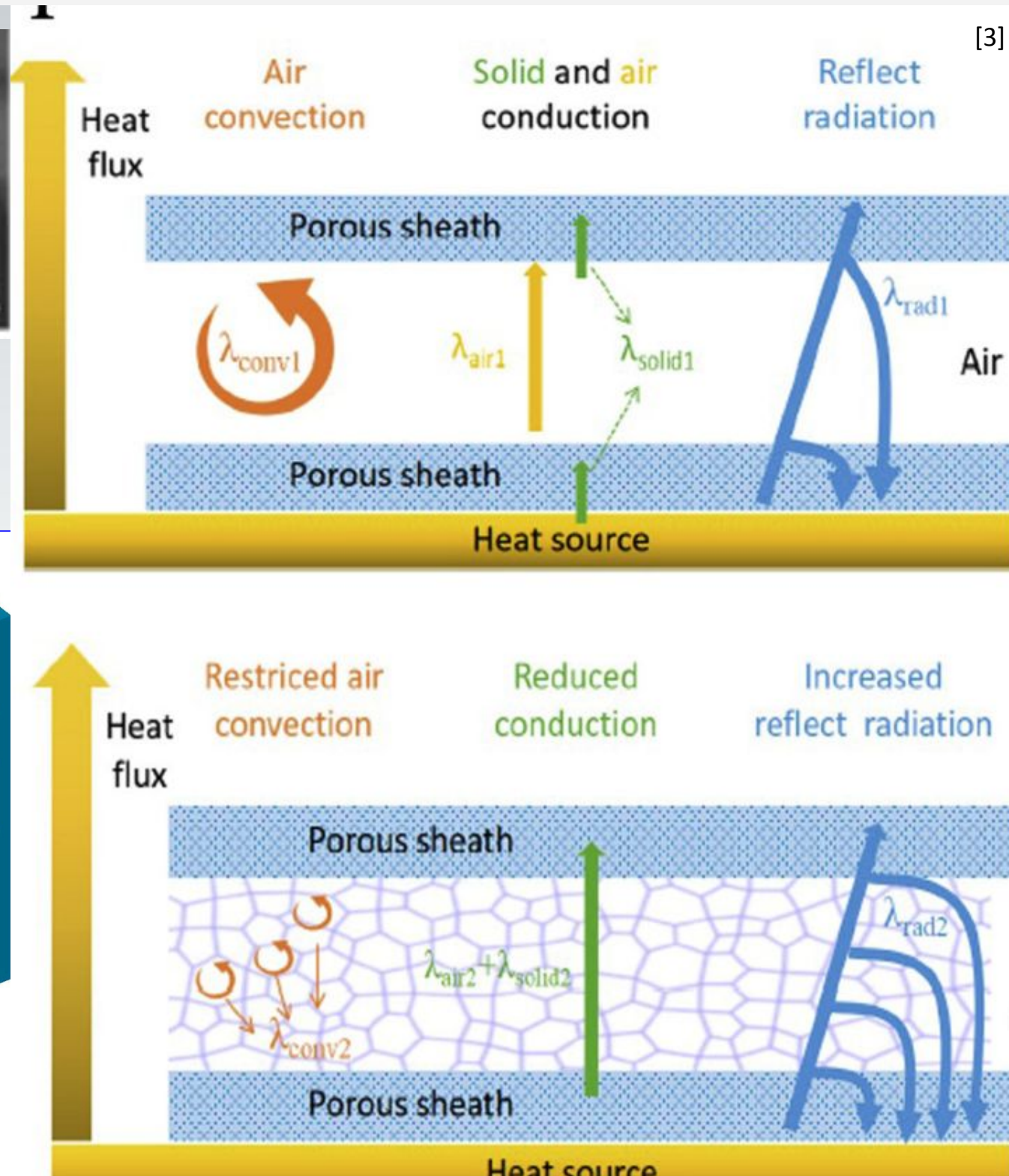
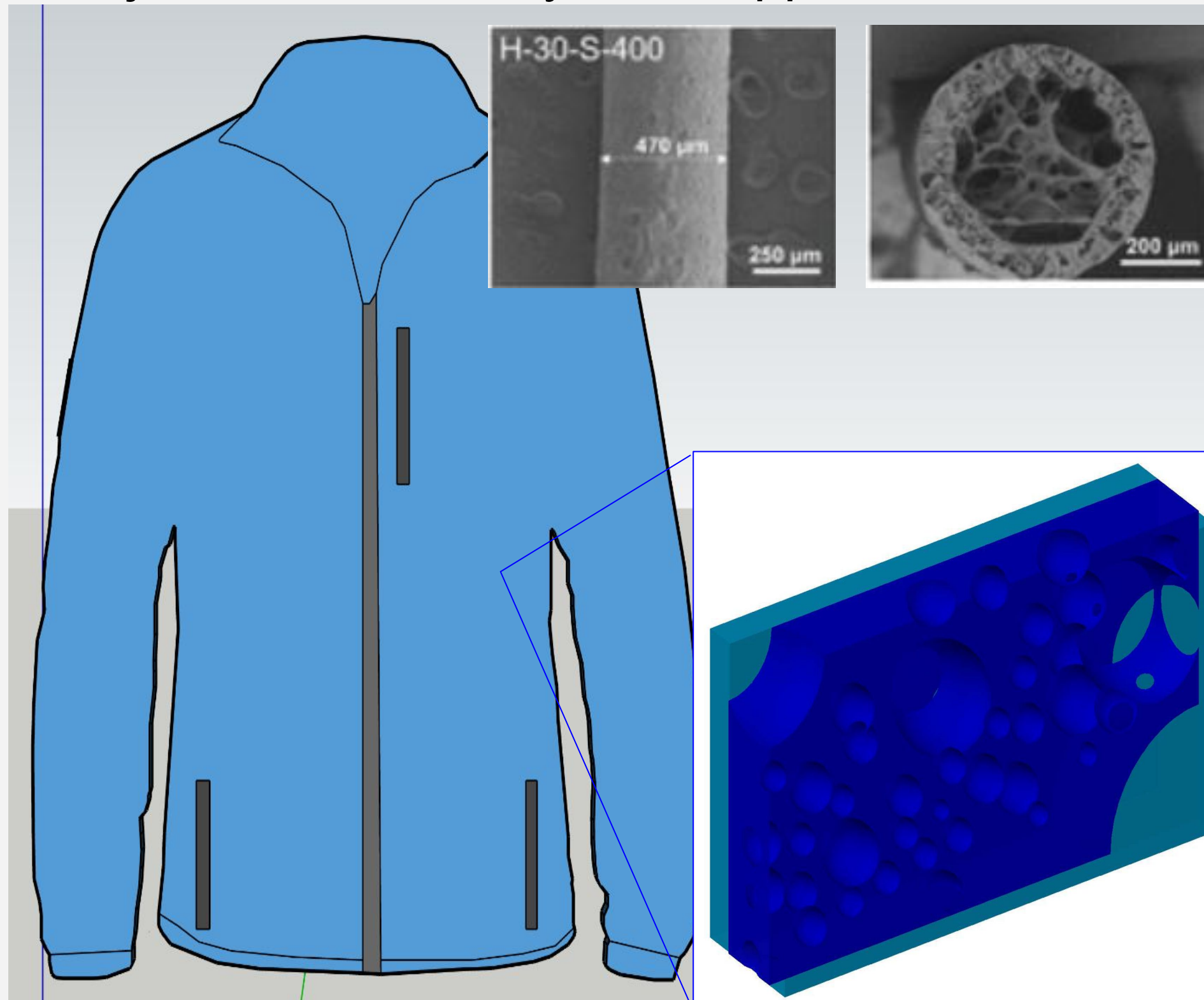
Product Specifications

Our jacket is made from one extra thin and light aerogel fiber insulation layer and two recycled polyester inner and outer layer. The aerogel fiber insulation layer has a thermal conductivity as low as 0.018 W/m*k, which is around 3 times better at insulation than regular wool sweater.

With thickness of 0.15mm and low density, the aerogel fiber layer weighs only 39g. The moisture-wicking inner layer and the wind and waterproof outer layer weigh 730g and are 2mm thick. For each layer, the jacket will use 2.7m² of each fabric. The jacket weighs 0.77kg in total and is 0.2mm thick.^[3]

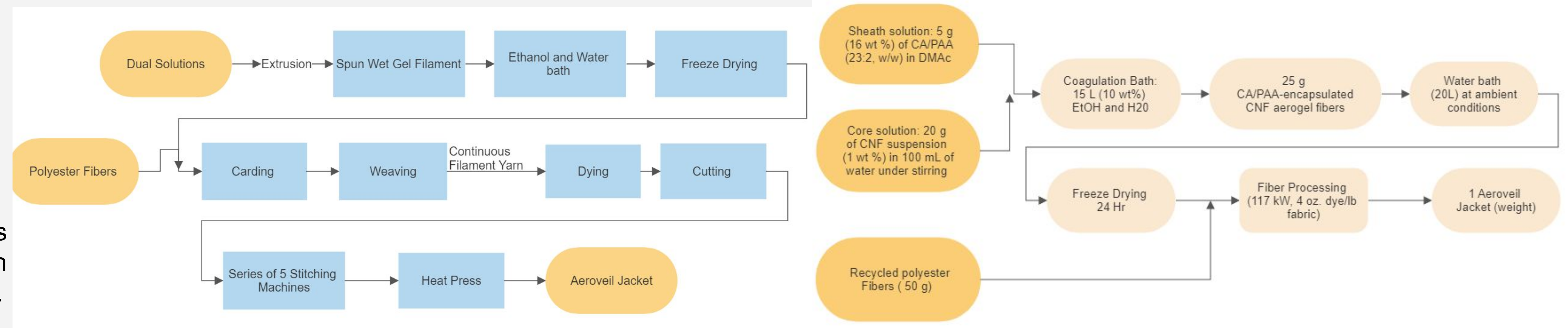


Below is a model of what the jacket will look like: a simple yet functional design with two lower pockets on both sides to hold small objects or keep your hands warm. An optional pocket on the chest can be included as well. The jacket is closed by a full zipper.



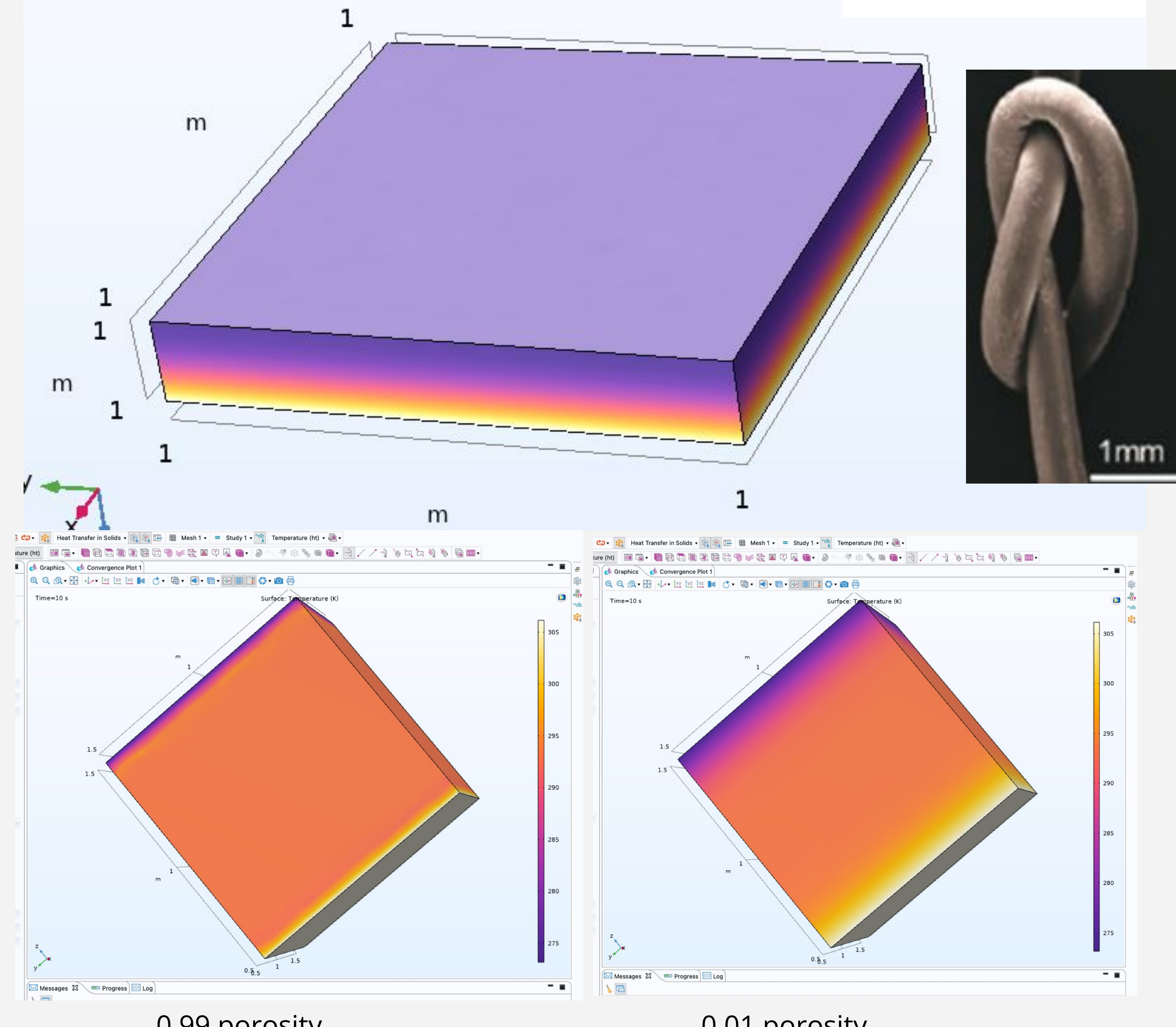
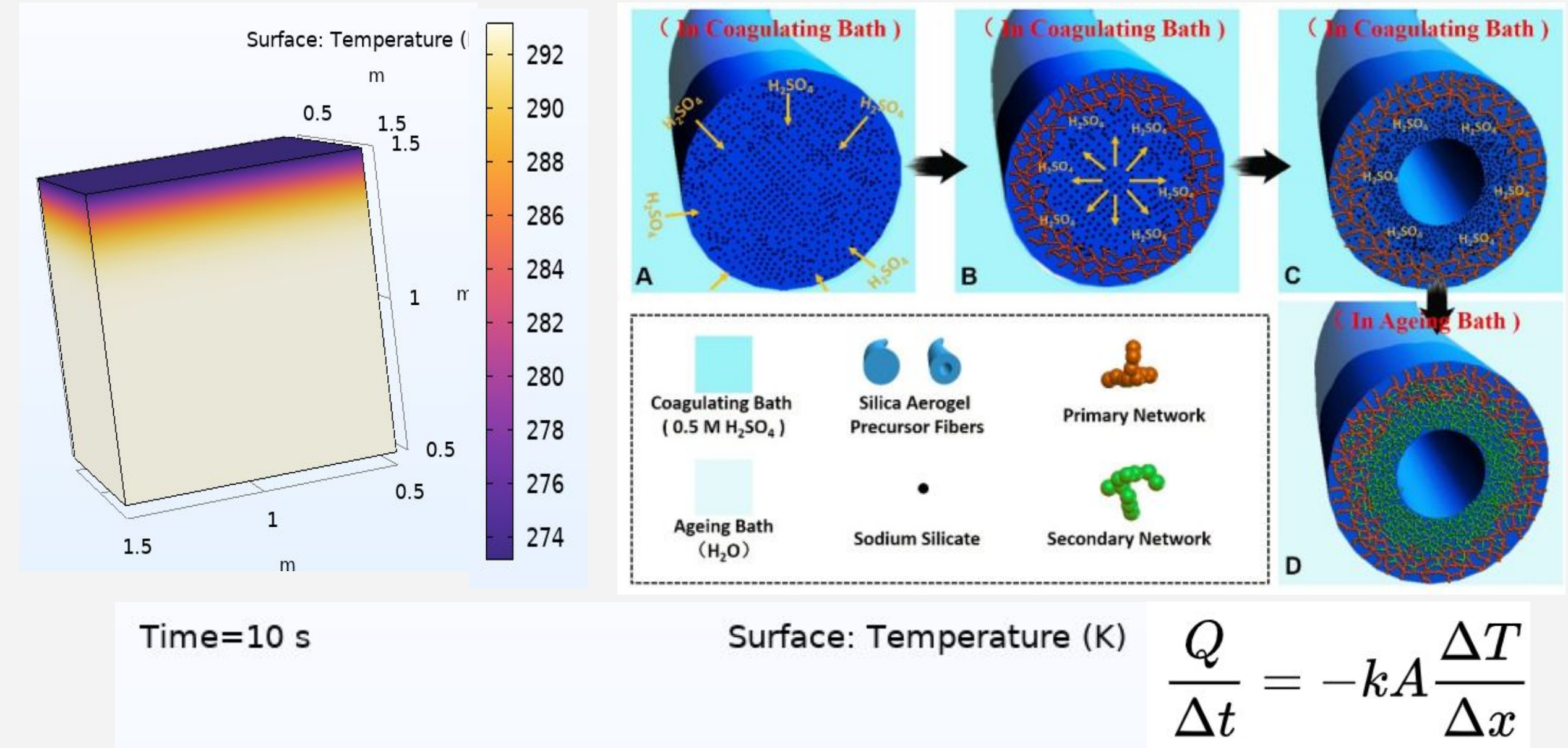
Manufacturing Process Description

Here are our manufacturing block diagrams, including the ratios of initial feed streams. They include all processing units for fiber creation and processing. [1][2][3]

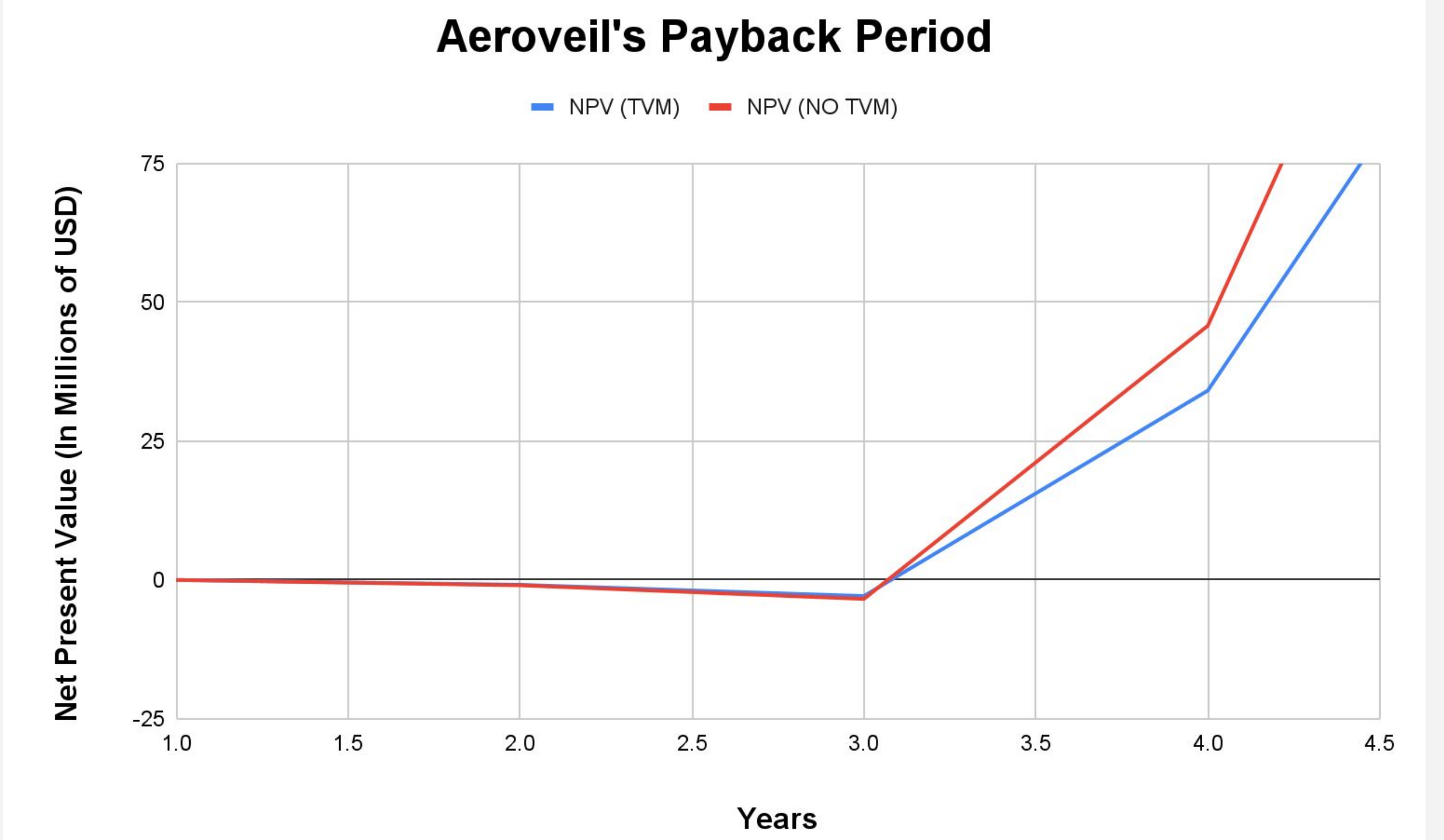


Comsol Models

We performed a basic feasibility calculation using Fourier's Law for Conductive Heat Transfer comparing our material to traditional wool. We found heat loss for wool to be 261% greater than aeroveil's in similar environments. We then made several time-dependent comsol models of aeroveil.



When do we project making a profit?



Our financial projections indicate that, regardless of whether we take into account the time value of money, our breakeven point occurs at around ~3.1 years. Our main costs are broken into 4 categories and have their associated values as shown:

- Developmental: \$960,000
- Capital^[6]: \$2,400,000 +/- \$60,000
- Operating^[7]: \$7,457,000, which recurs annually
- Business: \$3,341,000, which increases every year

We aim to sell 120,000 jackets at \$500/pc in year 3 and gradually increase our target for units sold, eventually reaching 1,200,000 jacket sales in year 10. Our ROI on 10 years of investment is 715%!

Conclusion

We set out to design a jacket that outperforms existing competitors by maximizing heat retained while minimizing weight and thickness. We have proven that such a design is possible, all while making a massive return on investment without price-gouging our future customers. Utilizing an innovative wet reaction spinning process to create the aerogel fibers that will line the interior of the jacket, we've created a product that will dominate the existing market and be of great benefit to the lives of millions of people that live in extreme cold climates and that enjoy cold weather activities.

1. Seaweed-Derived Alginate-Cellulose Nanofiber Aerogel for Insulation Applications
 Linn Berglund, Tuukka Nissilä, Deepantshu Sivaraman, Sanna Komulainen, Ville-Veikko Telkki, and Kristiina Oksman, ACS Applied Materials & Interfaces 2021 13 (29), 34899-34909
 DOI: 10.1021/acsami.1c07954

2. Seaweed-Derived Alginate-Cellulose Nanofiber Aerogel for Insulation Applications
 Linn Berglund, Tuukka Nissilä, Deepantshu Sivaraman, et al. ACS Applied Materials & Interfaces 2021 13 (29), 34899-34909
 DOI: 10.1021/acsami.1c07954

3. A review on multifunctional aerogel fibers: processing, fabrication, functionalization, and applications, O.A. Tafreshi, S.G. Mosanzenzadeh, Materials Today Chemistry, Volume 23, 2022, ISSN 2468-5194, https://doi.org/10.1016/j.mtchem.2021.100736.

4. Construction of continuous hollow silica aerogel fibers with hierarchical pores and excellent adsorption performance
 Si Meng, Junyan Zhang, Wengping Chen, Xingping Wang, Meifang Zhu, Microporous and Mesoporous Materials, Volume 273, ISSN 1387-1811, https://doi.org/10.1016/j.micromeso.2021.110736.

5. -40C NASA Spacesuit Tech Aerogel Warm Jacket Outdoor O2 AILIFE
 https://allifeholdings.com/products/40-outdoor-o2-nasa-aerogel-jacket?_pos=1&_sid=c4c1a48548_ssr#

6. Costs of Manufacturing Process Units FYITester, machineryoffers.com

7. Costs of Cellulose Acetate and Other Necessary Chemicals and Items ChemicalBook, Sigma-Aldrich, Fisher Scientific, Alibaba, ZipperShipper