How a closer look on penguin's plumage could potentially cause a revolution in the insulation industry

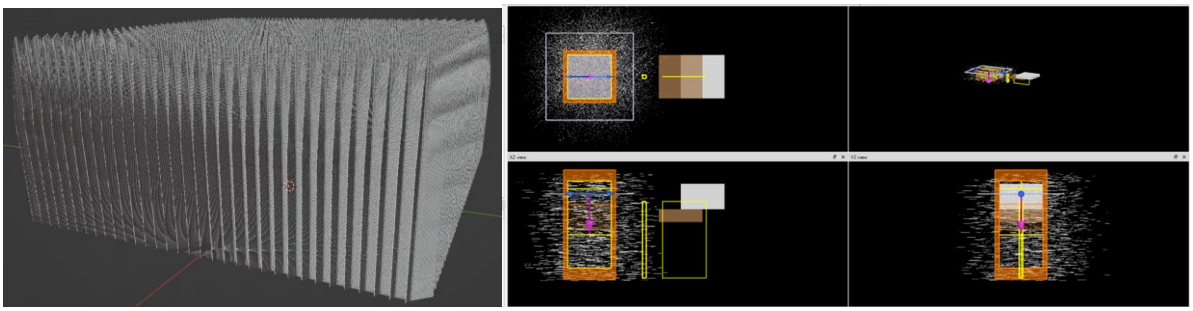
As we all know, insulation these days is a hot topic. With the realization of the urgency to act on climate change and the subsequent disastrous consequences it could elicit, an intensified focus on energy efficiency has risen. Therefore, it is interesting, both environmentally as economically, to diminish heat loss in our own houses. Also, with the rising temperatures, good insulation could preserve or even improve our 'living at home experience' in the future (as far as we are currently not living in climate change times).

But why the claim for a focus on penguins' plumage? These habitants of the Antarctic are, just like us, warm-blooded animals who must maintain a high average body temperature of 38°C (which is on average 1°C higher than humans) to maintain its metabolism. A big difference however in comparison to humans, ignoring the obvious fact that we are talking about birds, is the extreme temperatures they have to endure during their lives. The average temperature in the Antarctic's ranges from -10 to -57 degrees Celsius which is nothing compared to what we call winters in Belgium.

For us the question rose: what if we use the structure of the penguin's plumage to create a model for the insulation of houses? Not only are the average outdoor temperatures much milder compared to the extreme ones of the Antarctic, the differences in temperature between in- and outdoor are also less extreme. Could we use the design of the penguin's feather coat to create a thinner material? Could this be made cheaper than the insulation available now? And could this be designed in a way that it uses ecologically justified material?

But what exactly makes the insulation of the pinguins so exquisite? Although the presence of large amounts of bodyfat could be misleading as the cause of their high insulative properties, it only partly plays a role in the insulation and this solely in the water. On land, it's the plumage that is the vital tissue contributing to the insulation of the animals. More specifically, the relatively small radius of the barbules (4,56 µm) of penguin feather and their geometrical structure are responsible for the reduction of heat loss. Thus, to create a penguin-inspired insulation material, these are the two properties that need to be considered.

To achieve our end goal, a verified model for our product, we learned how to create 'Blender' models and we then tested the effect of various parameters through heat simulations in 'Lumerical'.



We truly believe that further research could ultimately lead to insulation of better quality for us and for the world. The retrieved data is promising but finding a production method was our biggest stumbling block. With more time, the different parameters could be tested out even more and the best method could be found to create this penguin insulation. We truly believe this could lead to a revolution in how we see and produce insulation. So, the big question is: are you with us?

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