ALTAIR DN 40 Meter Body Optimization

Substitution of Brass with Composite Plastic

Current version of ALTAIR water meter in brass body design
Diehl Metering S.A.S.

Diehl Metering S.A.S. is located in the French commune of Saint-Louis in the Alsace region and was originally founded in 1906 under the name of "Paris Ignicole". Today, the company has 290 employees and is a corporate division of the Diehl Group, which consists of diverse divisions in different industrial sectors and has nearly 16.300 employees at worldwide locations from Mexico to China, Diehl Metering S.A.S. develops, designs and produces water meters and radio-based meter reading systems. It also manufactures products for other companies in the Diehl Metering Group including the volumetric meter Altaïr. Diehl Metering S.A.S is a center of excellence for modern injection molding processes. Besides its own products, Diehl Metering S.A.S sells the whole Diehl Metering range and the corresponding services.

The Need for bionic lightweight design

The key component of any water meter is the body, which is classically made of brass. The material has proved itself by cast production and its corrosion resistance - the long life necessity for the water exposed meter body. But when it comes to large applications, scaling up the conventional brass design would simply lead to a heavy part with increased material usage which complicates casting. The solution is material substitution. But doing so, a redesign is needed to develop a meter body which fulfills the required mechanical resistance while considering the properties of the alternative material. By the innovative approach of bionic lightweight design, the structural development leads to an optimized part which fulfills all technical criteria while ensuring minimal material usage.

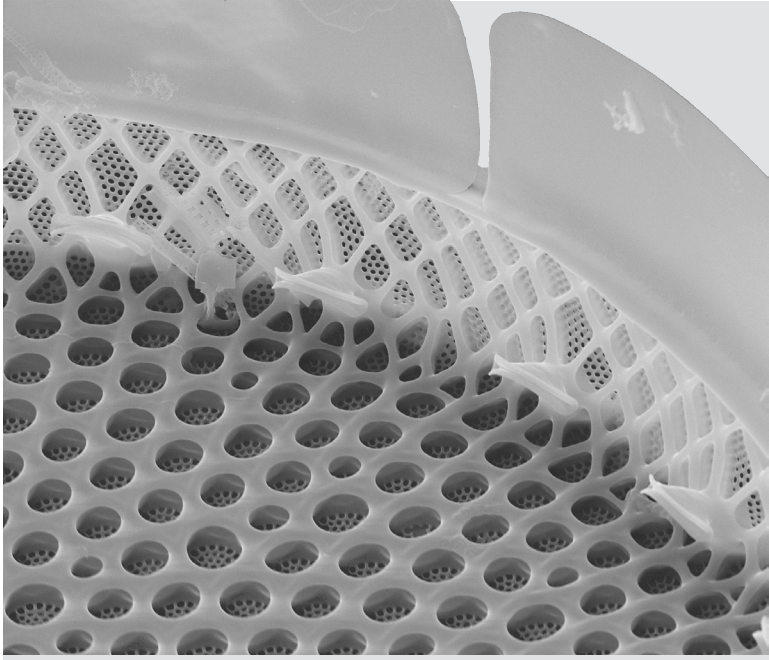
How did our solution help?

At the beginning, the technical specification sheet was worked out in cooperation with Diehl Metering. It contains all necessary information about the part, the load cases and manufacturing constraints for the composite plastic material. Based on that, the ELiSE team developed different meter body concepts.

Our bionic product development is based on microscopic plankton organisms (diatoms) which serve as natural archetypes. Their shells feature unique stiffening structures - lightweight design optimized over million years of evolution. The mechanical stiffening principles of selected diatom shells have been analyzed and transferred into technical applications of which the most advantageous led to the first meter body concepts.
Cooperatively, the resulting concepts were evaluated focusing the mechanical performance and the manufacturability. The two most promising designs were chosen for further lightweight optimization out of which the best performing design was chosen as final meter body design.

The Result

The final design leads the way for optimizing the future **Diehl Metering** product portfolio by realizing large scale water meters which are **lighter** and **cost efficient.** The bionic design benefits of the **successful material substitution** of brass with composite plastic while keeping the material usage and costs to a minimum.



Biological archetype: *Roperia*
A load adaptive honey comb structure stiffens the bottom and merges smoothly into crossing ribs stiffening the wall

"...With Elise, we have been able to make one step forward in design optimization. The mechanical resistance has been optimized by conserving the material and by reducing the weight. We are happy for any future collaboration."

Dr. Anne-Sophie Truchassou
Diehl Metering S.A.S., Head of Materials

ELiSE

Applied Engineering Tools

Following engineering tools and methods have been used for the project:

ELiSE Screening
ELiSE Concept
ELiSE Engineering

- CAD construction with Solid Works 2015
- FE-Analysis with ANSYS Workbench
- Topology optimization with OptiStruct
- Parametric optimization with OptiSlang
- Optimization with DoE and evolutionary algorithms

DIEHL Metering