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Introducing Functional Films & Hierarchical Riblet Structures

Tim Buscher, OPTIMAL Workshop, 20.11.2025

Agenda

1 | BASF Coatings at a Glance

2 | Functional Films

3 | NovaFlex SharkSkin

4 | SharkSkin & Beyond

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01 | BASF Coatings at a Glance

BASF Coatings in numbers

Automotive Business

~80%

Sales
2024
(excl. ECD)

€3.8bn

Nations
working at our Muenster site

49

Employees

~10,300

Net Sales 2024 from **Sustainable Solutions**

~36%

Female share
overall

25%

Countries

50

Female share
leadership

25%

Around 70 locations

Our key locations are listed below.

Surface Treatment	Blackman Township, Michigan | Canovelles, Spain | Çayirova-Kocaeli, Turkey | Guissano, Italy | Frankfurt, Germany | Sens, France | Pune, India | Shanghai and Pinghu, China
Automotive OEM	Bangpoo, Thailand |Greenville, Ohio | Guadalajara, Spain | Mangalore, India | Muenster, Germany | Shanghai, China | Tultitlán, Mexico
Automotive Refinish	Clermont de l'Oise, France | Jiangmen, China | Muenster, Germany | Windsor, Canada

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BASF Coatings in Muenster

The world's largest integrated paint manufacturing site

In operation since
1903

Square meters
427,000

Employees
~2,300

Nations working at our Muenster site
49

Trainees/ apprentices
~140

Business Units

- Automotive OEM Coatings
- Automotive Refinish Coatings
- Development center for Solutions Beyond Paint

Highlights

- The world's most advanced 2,000-square-meter automotive refinishing training facility
- Color Design Studio
- Application center
- Largest industrial employer in Muenster and the region



Internal

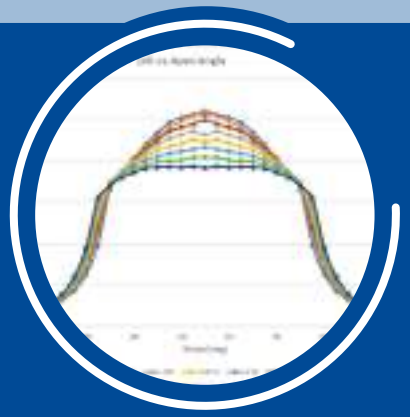
02 | Functional Films

Functional Films

Tackling challenges by using open innovation

Structure & simulation

- Structure design & simulation
- Effect simulation



Materials & process

- Strong material expertise
- Competencies in multi-layer systems



Product design and customer integration

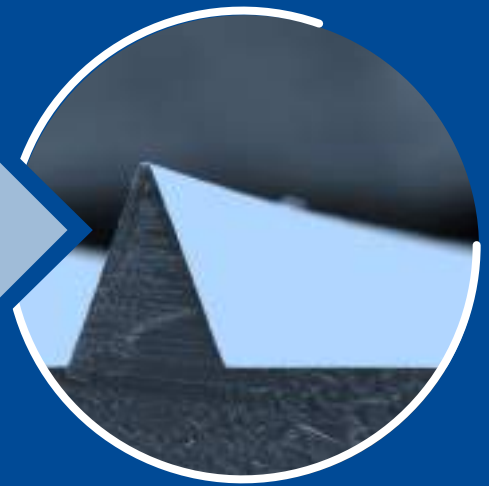
- Tailored product concepts
- Ready-to-use solutions



Scale-up & engineering

- Set up & run production
- Engineer & build production machines





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Functional Films

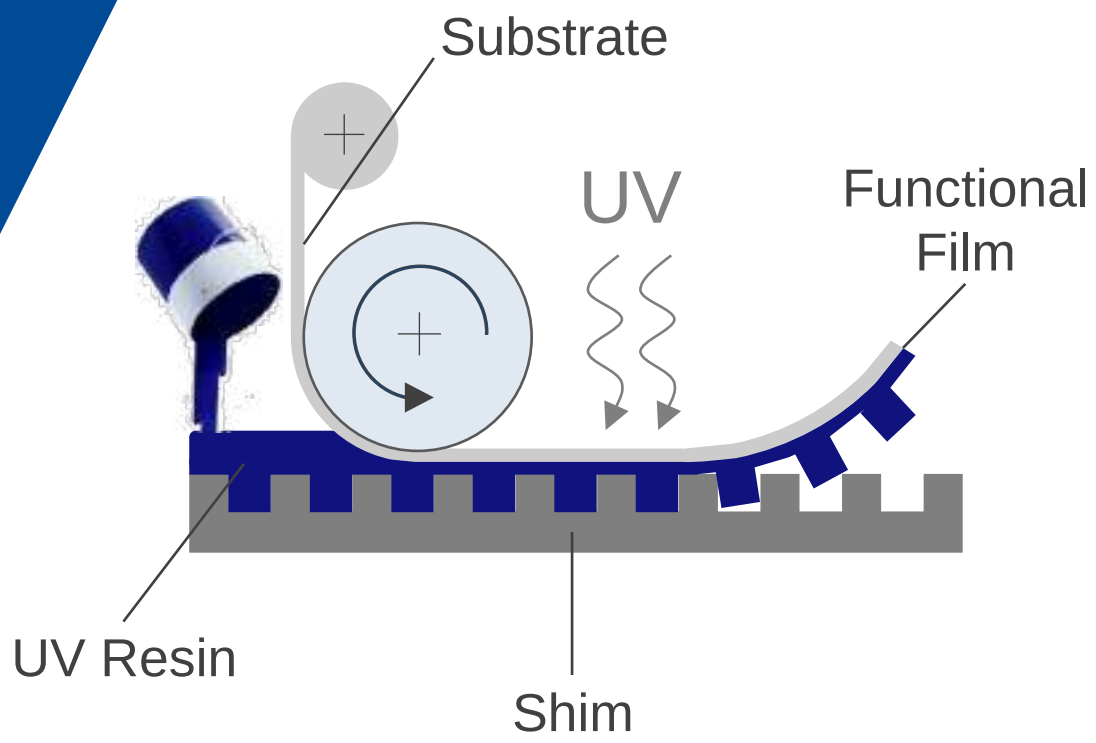
UV-Nanoimprint-Lithography (UV-NIL)

Toolbox

- Various UV resins with tailored properties (matched with substrates and adhesives)
- Properly designed micro-/nano-structures for peak performance
- Highly precise imprint tools based on a variety of materials and origination methods

Facilities

- One lab-scale R2P-UV-NIL for prototyping and development
- Three R2R-UV-NIL production lines for production with up to 1 m web width



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Functional Films

We focus on strategic business segments









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03 | NovaFlex SharkSkin

Flow Enhancing Films

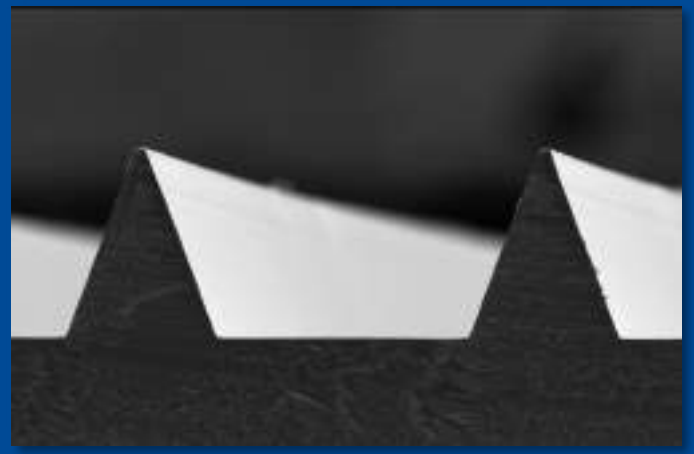
From Nature’s Inspiration to Industrial Innovation



Nature has perfected solutions over millions of years



We harness these natural principles - like the drag-reducing power of sharkskin - to create advanced technologies for real-world industrial challenges.



Inspired by nature, our riblet film technology is designed to provide clear advantages in aviation, marine, and other fields.

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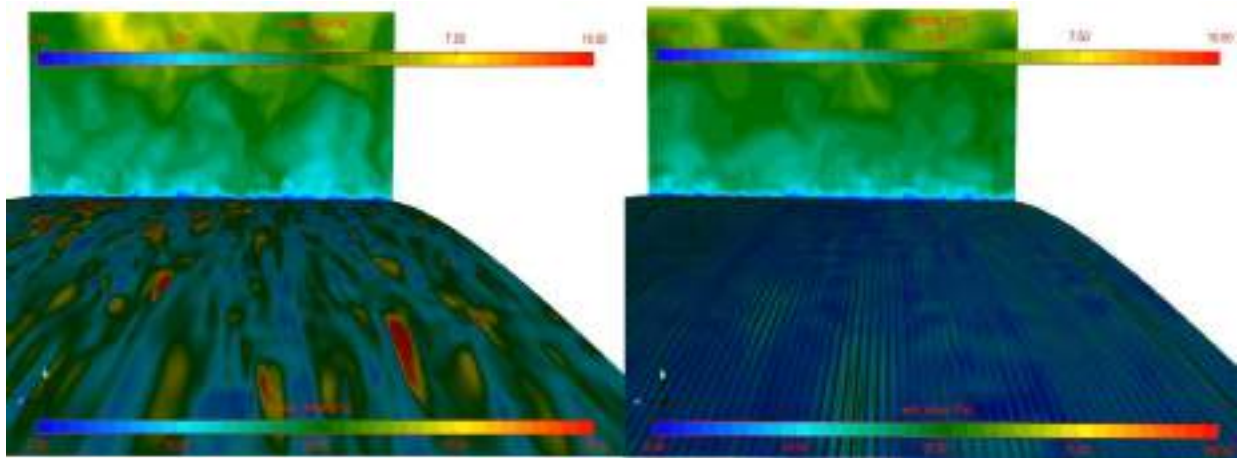
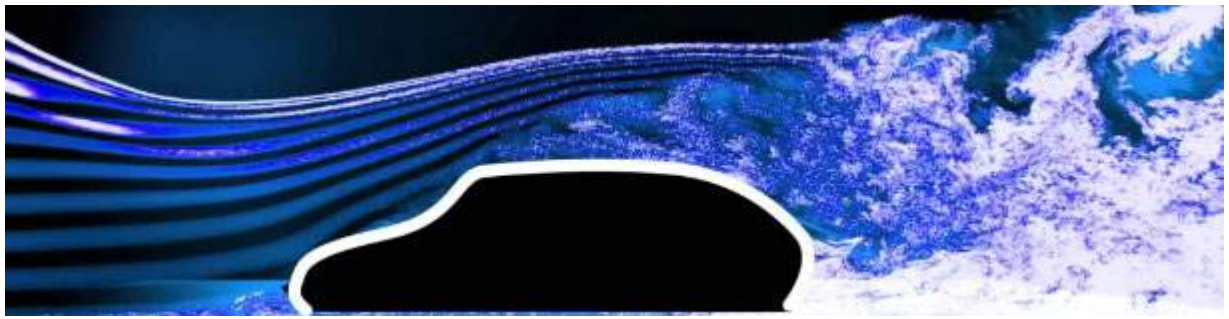
Flow Enhancing Films

The Sharkskin concept - Riblets reducing surface drag

Drag occurs between a solid surface and liquids / gases and results in…

- …increased energy consumption
- …speed decrease
- …instability
- …noise, vibration, harshness





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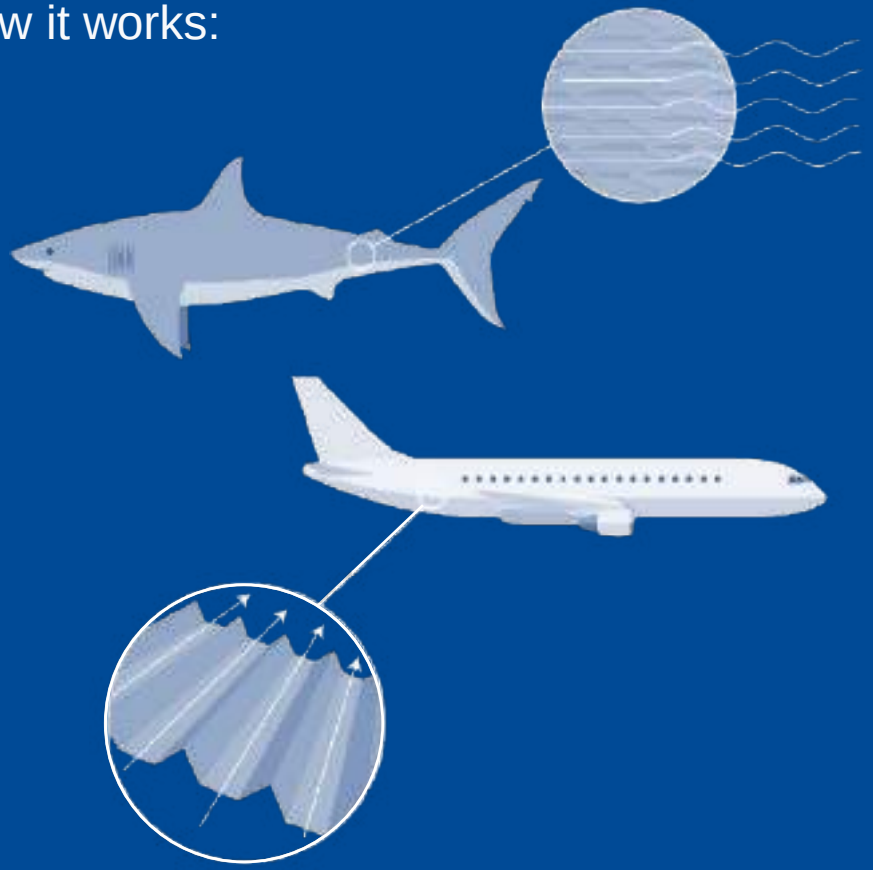
Why SharkSkin on Aircrafts?

Less aerodynamic drag, less CO_2

How it works:



Avoidance potential per year[1]

1.1%
drag reduction
(would be 3% with full-body lamination)

~400
metric tons kerosene

~2 million
metric tons kerosene

On one aircraft

For global commercial aviation

~1,250
metric tons CO_2
≙
200
circumnavigations of the world by car
(157g CO_2/km)

~6.3 million
metric tons CO_2
≙
1 million
circumnavigations of the world by car
(157g CO_2/km)

[1] Figures refer to using NovaFlex SharkSkin on SWISS's Boeing 777-300 fleet

Internal

Why using a film?
Films are the only viable approach

Other solutions

40 years of failed R&D

- Hot embossed films
  → material failure
- UV-imprint on Aircraft
  → certification, robustness, scalability
- Laser writing
  → accuracy, robustness, scalability

BASF Functional Film

What (our) films do better

- Durable & adaptable material
- Robust application process
- High structure accuracy
- Industrializable production process
- „Easy“ certification process

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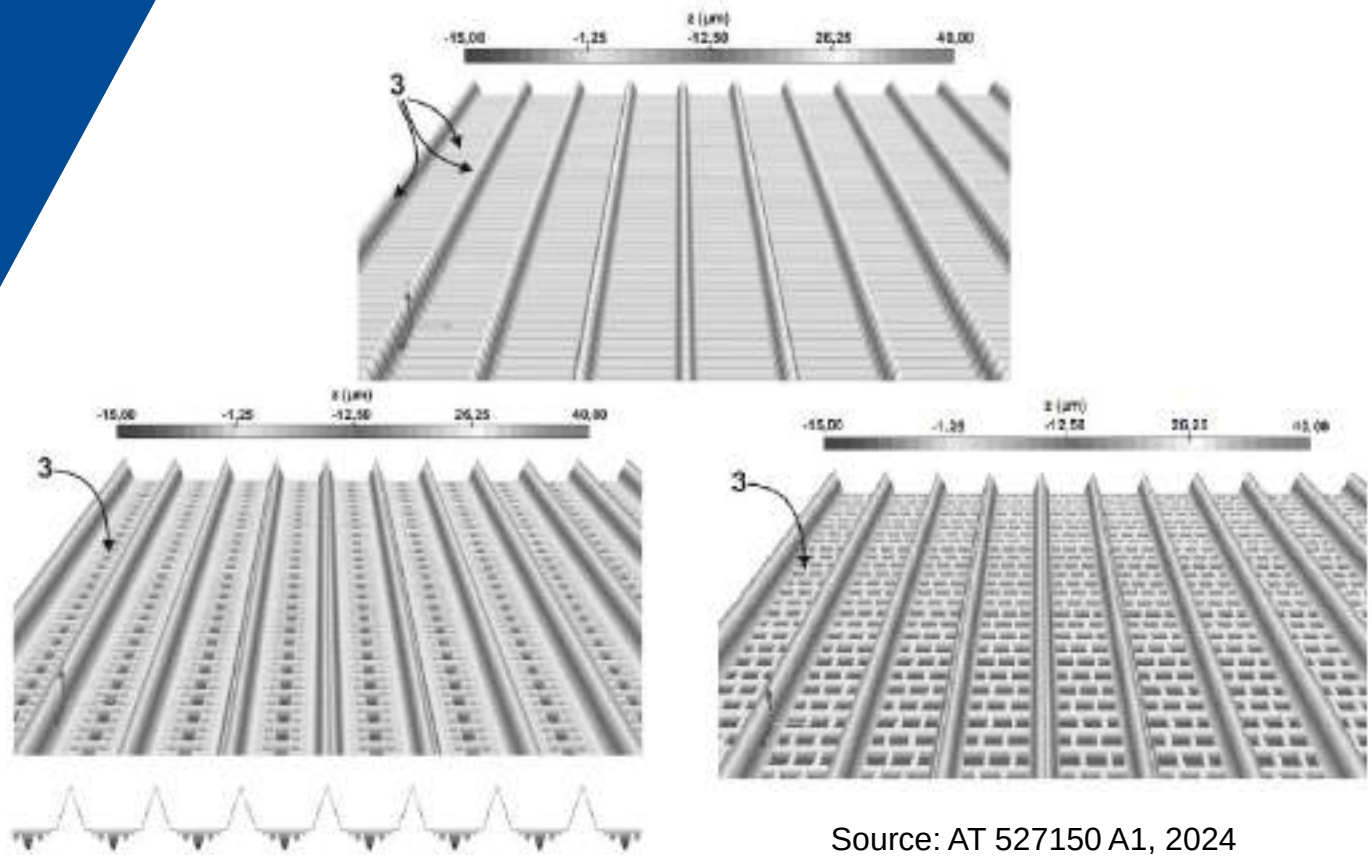
04 | SharkSkin & Beyond

SharkSkin ‘2.0’

How to reduce the drag even further?

- Introduction of periodically spaced features inside the riblet grooves to interfere with the flow dynamics along the channel walls
- Decrease of viscous drag by minimizing the effective interface area between the fluid and the surface



Source: AT 527150 A1, 2024

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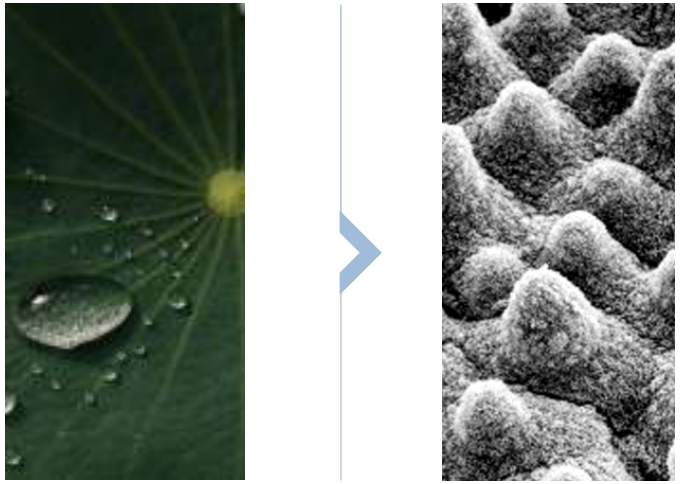
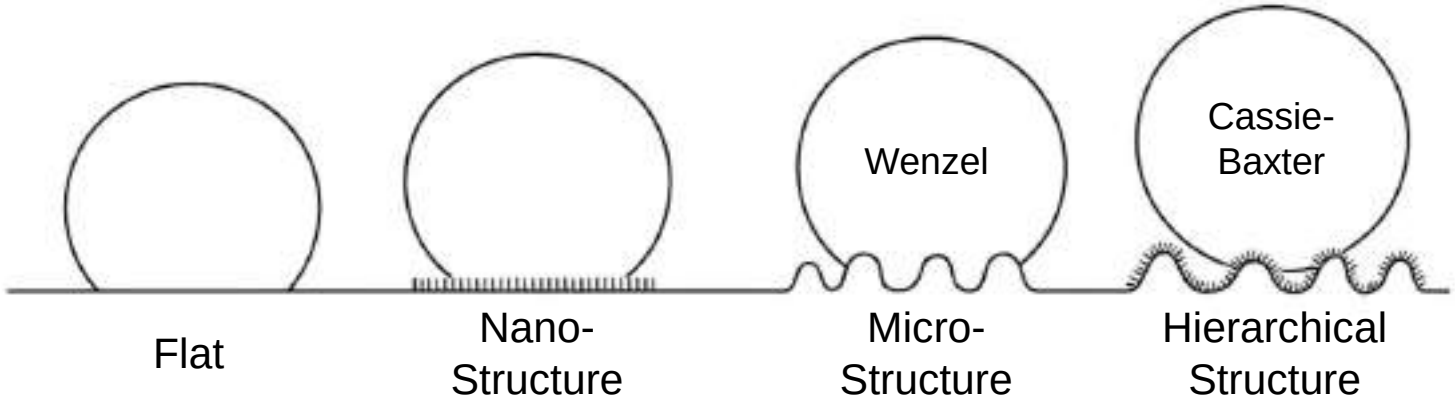
SharkSkin ‘PLUS’

… since there is a need for more



Langmuir **2004**, *20*, 8209-8213.



- Create hierarchical riblet structures enabling self-cleaning and anti-icing, inspired by lotus effect
  - OPTIMAL supports scalable industrial production of these biomimetic functional surfaces

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