



Femtosecond laser texturing as a sustainable surface solution | Series of LCA studies - part 1

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Surface modification technologies are at the forefront of industrial innovation, offering enhanced performance, durability, and specific functional attributes to a wide array of materials. Traditionally, coatings have been the primary solution for enhancing properties like corrosion resistance, wear protection, hydrophobicity, thermal insulation, among others.

The environmental burden of conventional coatings

Conventional coating techniques involve the use of chemical substances (such as primers, resins, and solvents) that contribute significantly to environmental degradation. These materials often contain volatile organic compounds (VOCs) that are released during the application and curing processes. Additionally, the application processes themselves are typically energy-intensive, requiring high temperatures and specialized equipment. Once applied, these coatings can degrade over time due to UV radiation, mechanical abrasion, and environmental exposure, which not only reduces their functional lifespan but also necessitates frequent maintenance or reapplication.

Introducing femtosecond laser surface texturing

In response to these challenges, femtosecond laser texturing has been studied and developed to be a sustainable alternative for surface modification. Laser texturing is a chemical-free, energy-efficient and environmentally conscious surface engineering alternative. This technique involves the use of ultrashort laser pulses to modify the surface of materials at the micro- and nanoscale. The pulses are so brief that they can ablate material without causing significant heat damage to the surrounding area. This results in highly controlled, repeatable patterns that can impart specific surface functionalities without chemical use.

Environmental benefits of laser technology

The environmental benefits of femtosecond laser surface texturing are substantial. Because it is a purely physical process, it eliminates the need for chemical substances entirely. There are no VOCs emitted, no hazardous waste generated, and no risk of environmental contamination from spills or residues.

Life cycle assessment (LCA) collaboration

To better understand these environmental advantages, Sirris made a partnership with B.Cycle, an affiliated company from UAntwerp, to produce a LCA (life cycle assessment) comparing 3 real cases where coatings or laser can be used as a solution for surface treatments: anti-icing property in a wind turbine blade; anti-bacterial effect in a door-knob; and the friction reduction in a bicycle wheel bearing.

Conclusion

This introduction sets the stage for a deeper look at how femtosecond laser texturing compares to traditional coatings in real-world use cases.

Discover the FEMTOFUNC project

This case study is part of the broader FEMTOFUNC research on biomimetic surface functionality.

[Discover the FEMTOFUNC project](#)

Series of LCA studies on the application of femtosecond lasers

In a series of 4 parts, we briefly describe our findings and show the extent to which a femtosecond laser outperforms coatings in terms of ecological footprint:

[Part 2: laser texturing vs. hydrophobic coatings in wind turbines](#)

[Part 3: laser vs. antibacterial coatings on door handles](#)

[Part 4: laser texturing vs. hard chromium coatings in bearings](#)

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