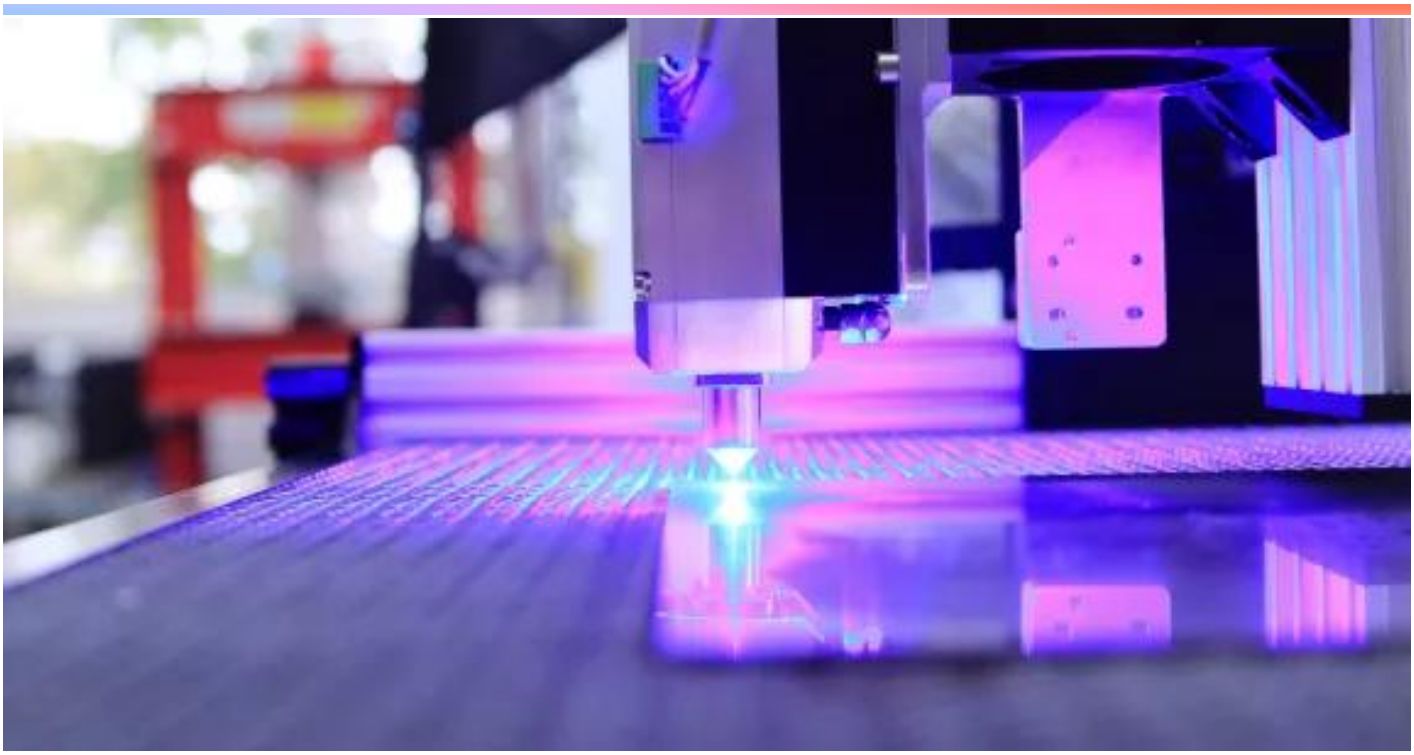


Femtosecond Laser Texturing: non-stick and glide without coatings!

01 July 2025, 11:09

Felipe Baroni

How Femtosecond laser texturing works

The key lies in laser-structuring stainless steel with microscopic precision. In nature, surfaces like lotus leaves or gecko feet use micro- and nanostructures to control water, friction, and grip. Femtosecond lasers allow us to do the same by engraving textures that influence how a surface behaves.

Sirris explored two key strategies:

1. LIPSS: Laser-Induced periodic Periodic surface Surface structuresStructures

These self-organized nanostructures arise due to the interference of incident laser light with surface-scattered waves, leading to periodic patterns with subwavelength features. LIPSS can modify the wettability and adhesion properties of stainless steel by enhancing hydrophobicity and reducing capillary forces that contribute to sticking.

2. Microstructures via laser ablation

The use of ultrashort pulse laser ablation enables the precise fabrication of hierarchical textures, including hatched patterns, microgrooves, and arrays of pits. These structures influence surface energy distribution and contact angle, reducing adhesion by creating a discontinuous contact area between the substrate and external materials.

High-Temperature Use: Frying pans that perform without PFAS

Nonstick frying pans are often coated with PTFE, better known as Teflon®. While effective, these coatings degrade over time and release harmful substances at high temperatures. Worse, they're hard to recycle and often end up in landfills.
With laser-textured stainless steel, we can eliminate these coatings altogether. The structured surface:

- Spreads oil more evenly
- Prevents food from sticking
- Resists heat and wear
- Enables healthier cooking with less fat

The result? A pan that performs like nonstick, that lasts longer and is 100% recyclable.

Low-Temperature use: wax-free ski bases

Fluorinated waxes used on ski bases may improve performance, but they leave behind microplastics and PFAS that contaminate snow and water systems. They also wear off quickly, requiring frequent reapplication.
With CIRCATEX, we're developing recyclable stainless steel ski bases treated with laser texturing to offer:

- Smooth gliding
- Water-repellent properties
- Reduced ice build-up
- No need for wax

It's a major step toward a circular, low-impact future for winter sports and a world-first in sustainable ski design.

More than coatings: a mindset shift

This research isn't just about replacing PFAS, it's about rethinking how we design surfaces altogether. Instead of layering on materials that degrade or pollute, we're building functionality directly into the base material through geometry and physics.

That's the heart of CIRCATEX: creating PFAS-free, circular solutions that work just as well, or better, than traditional alternatives. The potential extends far beyond pans and skis, with applications in automotive, aerospace, and consumer goods.

Conclusion: smart surfaces, cleaner world

Femtosecond laser texturing will allow us to build the next generation of nonstick, low-friction products without relying on environmentally harmful coatings. Whether in the kitchen or on the slopes, laser-treated stainless steel is showing us that sustainability and performance can go hand in hand.

This article is part of the CIRCATEX project, a research initiative led by Sirris, focused on developing PFAS-free nonstick applications through advanced surface texturing.

CIRCATEX investigates how micro- and nanostructures, created by ultrashort pulsed lasers, can replace traditional chemical coatings like PFAS in cookware and ski equipment. The goal? Durable, recyclable and high-performance surfaces, without environmental compromise.

CIRCATEX is supported by NextGenerationEU through the Belgium Builds Back Circular (BBBC) programme.

Authors



Felipe Baroni