



Ultrafast Laser-induced Surface Texturing to enhance Stainless Steel gliding on Snow

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Alpine skiing is the most practiced winter sport globally, constantly growing thanks to the development of East Europe and Asian countries. Italian ski resorts are visited by more than 22 million skiers, on average, each year creating a market value of more than 10 billion euros [1]. Such a strong interest poses questions about the sustainability of this sport and the associated equipment.

The ski base is the outermost layer that comes into contact with the snow. It is currently made of ultra-high-molecular-weight polyethylene (UHMWPE) treated with waxes to increase the gliding efficiency. While skiing, the base progressively wears down due to friction with the snow, releasing microplastics and harmful substances into the environment. Wear is more severe on artificial, highly compacted, aggressive snow that is commonly found on slopes. Additionally, the multi-layered structure of the skis makes their disposal complicated. Stainless steel (AISI 301H) is a substitute for UHMWPE, offering superior wear resistance and extending the average lifespan of a ski. However, an untreated steel surface has a higher friction coefficient with snow than the polymer, reducing the ski performance.

Surface laser micro-texturing has been demonstrated as a viable solution to decrease friction in different regimes and applications [2-3]. Laser Induced Periodic Surface Structures (LIPSS), with nanometric features, generated through femtosecond laser interaction with AISI 301H have also been proven to decrease its friction coefficient with snow [4]. Here, morphological features of LIPSS on steel and microtextured samples via femtosecond laser ablation are characterized by SEM, optical microscopy and contact angle measurements. The friction coefficients, measured on a snow tribometer with different snow conditions, are compared to the UHMWPE reference values.

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