ABSTRACT
A large number of space applications require black non reflective surfaces (for thermal control and optical properties). The use of laser radiation is a highly promising technology for various modifications of technical surfaces. Besides bonding pre-treatment or the change of tribological properties, this technology can be successfully applied to selectively modify optical and thermo-optical properties of different materials.
In this paper it is shown how laser surface modification can be used to reach black functionalised surfaces with very low reflectivity and high absorption for enhanced device performance.
Laser texturing of a surface can cause significant deviations in how light is reflected and scattered, leading to enhanced absorption.
A portion from a ray of light will specularly reflect from a flat surface, and have no further interaction with the material (a), on the other hand, protruding features can reflect and scatter light back onto the surface (b).

Light can effectively become trapped in crevices and holes where multiple reflections enhance the coupling into the material. Once inside these protruded structures, multiple internal reflections can guide the light into the bulk.
The degree of enhancement depends on the particular geometry and dimension of the surface features.
In addition to that, because no additional material is added, these textured surfaces are inherently more stable and do not suffer problems such as weak adhesion, thermal expansion mismatch or inter-diffusion.

The final microstructure, such as the shape of the cones or columns, their regularity as well as their density on the surface, depends strongly on the variables involved in the processing such as the power density and the applied interaction time. Additionally, the material properties itself, as well as the geometry (e.g. very thin material) of the substrate, influence the process.

Those new developed black surfaces by laser surface modification show excellent thermo-optical and optical properties with an absorptivity $\alpha=0.98$, emissivity $\varepsilon=0.94$ and a specular reflectance below 0.05%.

In summary, laser texturing could be a suitable technology to be applied in space hardware like thermal control or optical devices requiring special optical or thermo-optical properties.