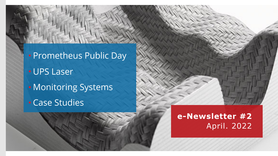
PROMETHEUS

PAPID ULTRASHORT PULSE LASER SURFACE TEXTURING TECHNOLOGY



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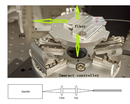
e-Newsletter #2
April. 2022

Prometheus Public Day

A **Public Day event** was organized on the 23rd of November 2021, gathering several industrial stakeholders from different sectors to present the main results obtained and developments of the project.
This event was initially planned to be hosted physically at MTC facilities to allow a real time live demonstration of the system to be carried out. However, this was not possible to be carried out physically as the pandemic situation did not improve.
Alternatively, the event was readapted to be hosted on-line.

USP Laser

USP lasers are ideally suited for surface texturing and ablation applications on temperature sensitive materials and substrates. Whilst USP laser processes have been widely applied in industrial applications already, their widespread up take has been limited due to four main technical limitations of current laser surface texturing.
Ultra-Short Pulse (USP) lasers from **EdgeWave** have pulse durations in the nanosecond regime down to the femto-second regime.
The average laser power will be increased to power within nanosecond lasers towards 1 kW. We will initially start with pulse durations in the range of 5-15ns and then seek to develop to a few hundred picoseconds.
The pulse energy may be as high as 100 mJ.



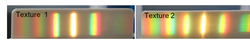
At the moment the oscillator development is successful with an amplifier architecture.
Some tests of hole fiber with nanoseconds laser done and know is ready to be combined with an innovative **Direct Laser Interference Patterning (DLIP)**.

Monitoring Systems

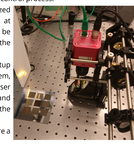
The laser texturing processes carried out by the **PROMETHEUS** machine will be monitored live with novel closed-loop technologies to correct any process deviation in an innovative way and ensure the high yield of the machine.
For the process monitoring and quality control, **two different systems** have been developed within the **PROMETHEUS project**, both based on the diffraction of light principle:
AIMEN has developed a scatterometry setup focus on detecting the 0th order at different wavelengths.
The following picture shows how the scatterometry setup built during the PROMETHEUS project works:

2. Texturized surface with line structure and hydrophobicity

As can be seen in the following picture, different diffraction patterns are generated for different textures:



A machine learning algorithm was created and employed to classify the spectrums generated by different laser textures.
In this way, it was observed that failures modes can be identified with a confidence interval between 80% and 100%. If a failure is identified, this would be communicated to the machine in real time and corrected if possible, closing the loop of the control process.
The picture shows the customized setup mounted and tested at laboratory scale, which will be integrated inside the **PROMETHEUS** machine.
With this new and innovative setup together with a close-loop system, we will be able to monitor the laser texturing process in real-time and ensure a maximum yield of the **PROMETHEUS machine**.
This close-loop system will ensure a maximum yield.



Design, development, optimization and ***installation of hardware*** based on diffractometry principle associated to image processing of the diffracted light pattern captured by the prototype.
Development of software with a user-friendly interface and image analysis with **machine learning capabilities** for the optimization and real-time monitoring of the surface treatment.

Functional surfaces:
- Wetting properties
- Self-cleaning
- Friction reduction
- Antibacterial properties

Benefits for end users:
- Quality control for functionalized surface providers
- Fast and low-cost in-line monitoring system
- Accessory for laser and DLIP manufacturers
- High potential for industrial applications

Case Studies

Arçelik case study
In the **ARÇELİK** studies, it is being decided how the water retention (hold) tendency changes when we apply it to different surfaces of the machine.

Some results at the moment:
- Very low water retention tendency on the side surfaces. This contact angle looks good for the side surfaces.
- Some water droplets still remain in the upper area. Efforts are underway to ensure that this area is completely free of droplets.

M40 Project Meeting

PROMETHEUS Consortium meets again... but this time in person!

EWF hosted the **40th Monthly Meeting** of the **PROMETHEUS Project** at its headquarters in Oeiras, Portugal, on 20 and 21 April 2022. This was the first time since December 2019 that the partners met physically after the pandemic strike, so it was a great opportunity to discuss in detail some issues and gradually return to normal project meetings.

The partners discussed the **validation** and **demonstration** plan for the **4 end users cases** in the actual **PROMETHEUS machine!**
As the project is approaching its end, partners discussed the business plan and the impacts of the project.
This will allow us to better design future promotion and exploitation strategies directed to the industrial stakeholders.

Lastly, we also had training opportunities!

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