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## PoLaRoll M18 Newsletter

### PoLaRoll: Polygon scanner based ultra-short pulse laser processing in roll-to-roll manufacturing

Project duration: October 2016 – September 2019

PoLaRoll is a research project funded by the European Union's Horizon 2020 research and innovation programme. PoLaRoll Innovation Action has the aim to integrate, for the first time, high speed ultra-short pulse laser ablation process into a roll-to-roll machine fulfilling the requirements of individualised laser-based mass production. The project, with duration of 36 months (October 2016 – September 2019) and a total budget of 4.4 Million Euros, brings together leading European research institutions and companies active in the laser manufacturing systems domain.

The overall objective of PoLaRoll project is to substitute the lithography step in current etching processes by directly structuring the UV-sensitive lacquer with the PoLaRoll laser micro machining unit. The PoLaRoll module will replace the current masking process within a continuous UV-lithography etching process for micro-structuring stainless steel reels. This will enable a flexible and cost efficient process consequently increasing significantly micro machining productivity. Furthermore, the modular concept of the laser structuring system will allow the integration into several other applications in order to substitute masking processes or direct digital structuring.

To achieve its ambitious goal, PoLaRoll project chases the following objectives:

- Objective 1: Development of an ultra-short pulse laser ablation process. The development of a high performance ultra-short pulsed laser source is focused on a huge improvement on the system's pulse repetition rate and pulse energy. For a fast laser ablation of the lacquer, it is indispensable to perform extensive parameter studies in order to achieve highest accuracy combined with high ablation rates. The ablation rate depends on the laser process itself but also on the lacquer formulation. The laser parameter studies are performed by Fraunhofer IPT and Lasea.





Figure 1: Existing 5-axes laser machine tool for laser-based lacquer ablation.

- Objective 2: Development of a high speed polygon scanner. Besides the increased specification levels of the laser source, the polygon scanner will be further improved to cope with the new high processing speeds and the high pulse repetition rates achieved.
- Objective 3: Development of an in-line measurement for polygon scanner processing. To ensure a high precision for the material micro machining, two in-line measurement systems will be developed. On the one hand, the solution will address the direct measurement of the innovative UV-sensitive lacquer ablation results. On the other hand the solution will measure the resulting micro structures and perform an inline evaluation of its form and position.
- Objective 4: Laser based micro machining system with synchronisation between laser source and multiple polygon scanners. To cope with the high processing speeds and the high pulse repetition rates achieved, the project will concentrate on the implementation of a highly innovative ultra-fast synchronisation unit for at least two polygon scanners operated with one laser source, which will allow the fully usage of the system on a real industrial context.
- Objective 5: Integration of laser based micro machining system for two sided laser structuring into a roll-to-roll process. A further objective is the integration of the final laser micro structuring system including the enhanced ultra-short pulsed laser source and polygon based scanning unit as



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well as the in-line measurement systems in a roll-to-roll system. Guidelines have been prepared as presentation of substantial aspects of the occupational safety and health protection for the operation of the laser ablation roll-to-roll system. This guideline will be extended during the system development and will be adapted if changes or additions are necessary.

For the evaluation of PoLaRoll laser micro structuring module application on individualised high speed roll-to-roll manufacturing, the developed module will be directly integrated into one of the project end-user's (Micrometal) production line. The field of application of the demo is within solar shading of glass facades. The quality of the shield that will be produced with PoLaRoll machine will be directly assessed observing the optical inhomogeneity of the patterns which is directly connected to production process defects.

PoLaRoll consortium is led by Fraunhofer Institute for Production Technology IPT (DE). The consortium is well-balanced in terms of involvement of research institute, industrial and SME partners, including a potential end-user of the project results: Fraunhofer-Institute for Environmental, Safety, and Energy Technology (UMSICHT), Laser Engineering Application SA (LASEA), Amplitude Systemes, Micrometal GMBH, Next Scan Technology BVBA, Rina Consulting Spa, Lunovu GMBH.

#### Project Details

Project No: 723805

Start Date: 01/10/2016

Project Duration: 36 months

More information on PoLaRoll can be found on project (<http://www.polaroll-project.eu/>) and the Horizon 2020 website ([https://cordis.europa.eu/project/rcn/205597\\_en.html](https://cordis.europa.eu/project/rcn/205597_en.html))

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