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Real Time In-Line Monitoring
in laser surface processing applications

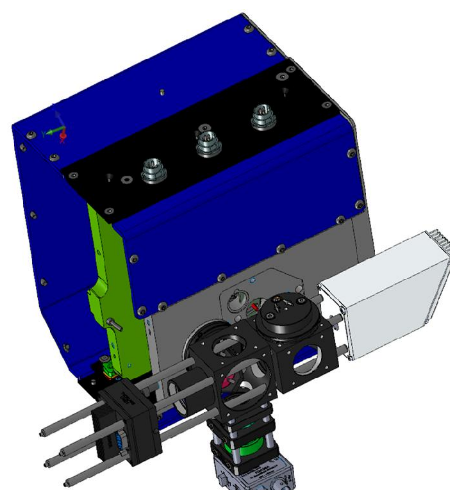
As a participant in the project APPOLO (Hub of Application Laboratories for Equipment Assessment in Laser Based Manufacturing) under the FP7 EU framework, Amsys has adopted its surface inspection technology for real-time in-line monitoring of laser processing of surfaces. Although the first application deals specifically with laser scribing of CIGS layers in manufacturing of flexible PV systems, the developed tool is directly applicable to a wide variety of laser scribing, patterning, and surface conditioning applications.

The monitoring tool is a flexible modular system which is integrated into the laser scanning system of the processing equipment. The tool functions by directing one or several monitoring laser beams along the path of the technological laser beam, and collecting the scattered light along the return path through the scanning system. The collected light is directed into a high-sensitivity high-speed detection system, digitized, and processed. Candidate defects - deviations from the nominal pattern - are flagged, analyzed in real time, and their location and characterization are reported.

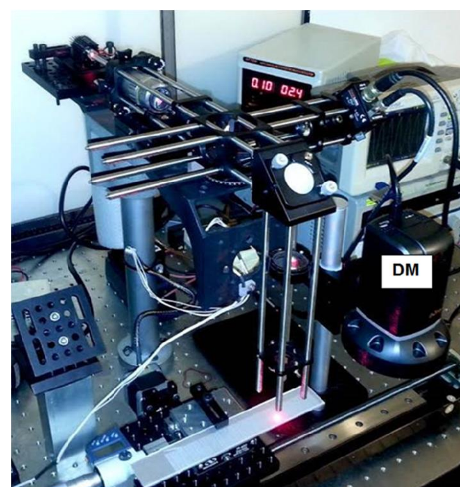
Statistical parameters of the digitized signals are measured, providing evaluation of statistical characterization of the surface itself, such as surface rms roughness, waviness, etc.

The tool is also equipped with an integrated high-resolution digital microscope which can automatically provide detailed pictures of areas flagged by the detection system or taken on-demand by the operator.

The tool was designed for integration with the laser scanner LS170 manufactured by Next Scan Technologies (NST), but it can be readily incorporated into any other scanning equipment.



Monitoring system (detail) integrated with LS170 polygon scanner of Next Scan Technologies (NST)



Monitoring system integrated with a laboratory scanning system at Amsys

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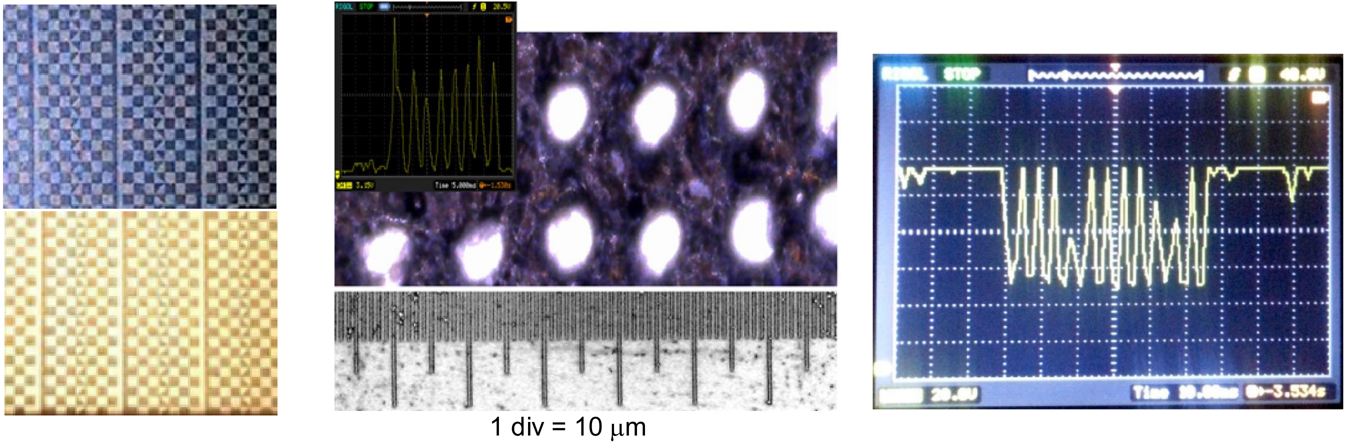
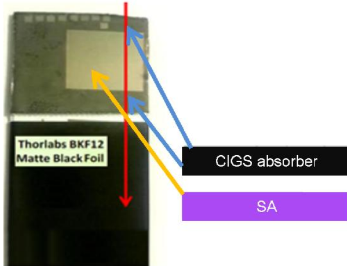
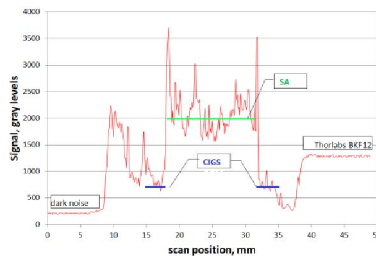
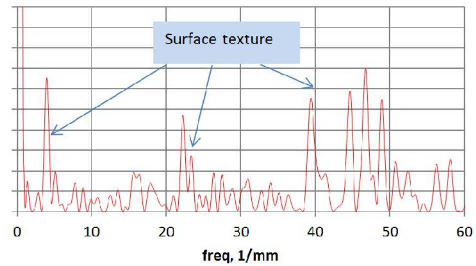


Black and white anodized samples scribed down to pure aluminum (courtesy of NST) and their scans. Picture obtained by imaging channel. Note the reverse contrast in white-anodized scan.

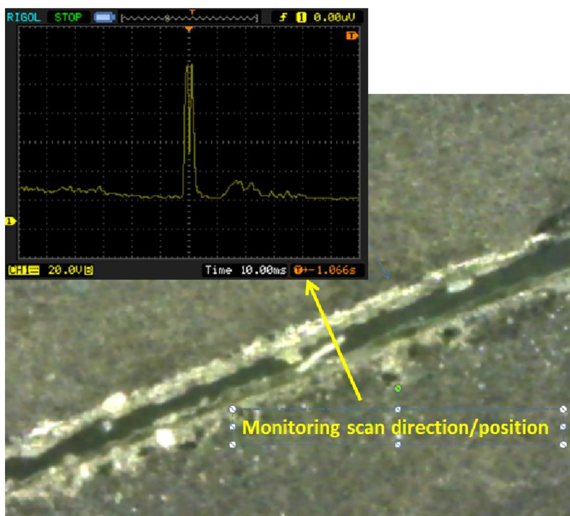




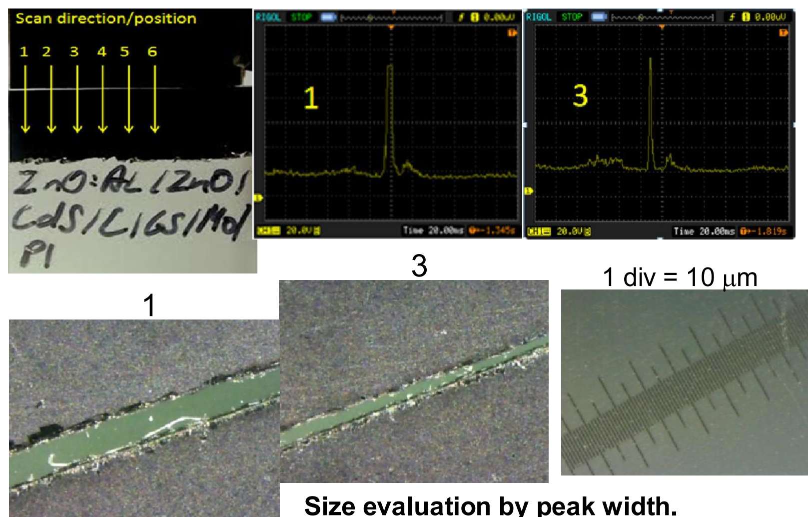


Scan of scribed CIGS samples (courtesy of FTMC – Center for Physical Sciences and Technology, Vilnius, Lithuania). SA = surface area with CIGS layer scribed out

Surface characterization by monitoring signal analysis. Texture formed by partial overlap of scribing laser pulses



Scribing debris detection and review by imaging channel. Sample courtesy of FTMC



Size evaluation by peak width.
Size measurement upon calibration and spot size deconvolution

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