Embedded Life-Cycle Management for Smart Multimaterials Structures: Application to Engine Components

MORPHO FINAL CONFERENCE

Verification of surface preparation of scarf repair by laser-based cleaning and spectroscopy technologies

D. Diego-Vallejo, A. González, E. Santamarina, J. Cuartero, T. Delgado, I. Portela, C. Alleaume, C. Prieto

AIMEN Centro Tecnológico, O Porriño - Pontevedra, Spain

GENEX Project - New end-to-end digital framework for optimized manufacturing and maintenance of next generation aircraft composite structures

The main goal is to develop a novel end-to-end digital twin-driven framework providing: a holistic approach covering the whole value chain of composite parts, from design, material, and manufacturing to operation, MRO, and EOL to support the next-generation digital aircraft transformation

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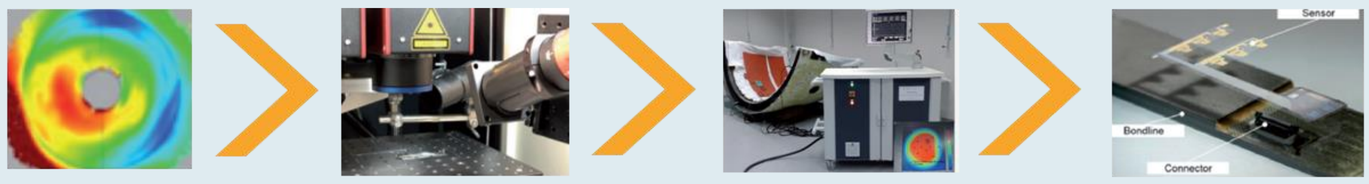
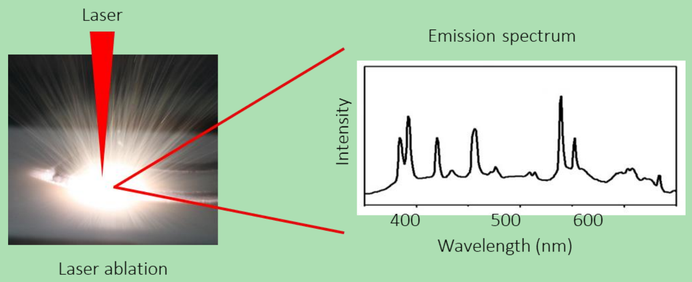
Digitally-assisted repair processes & tools



Visual assistance | Surface verification | Digital twin | Repair sensing

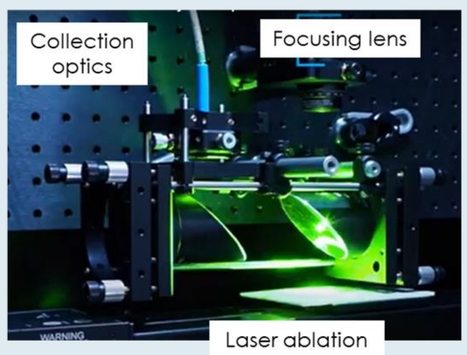
LIBS (Laser-Induced Breakdown Spectroscopy)



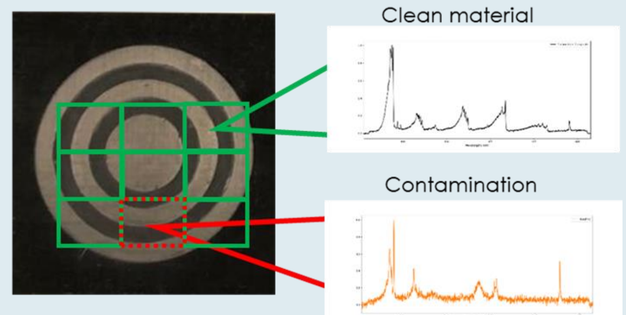
- Spectroscopic technique for chemical analysis
- Analysis of plasma generated during laser ablation

Surface prepared for repair

LIBS analysis

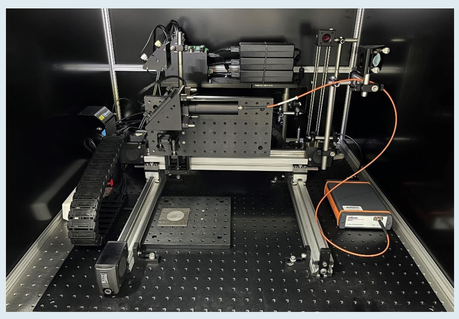


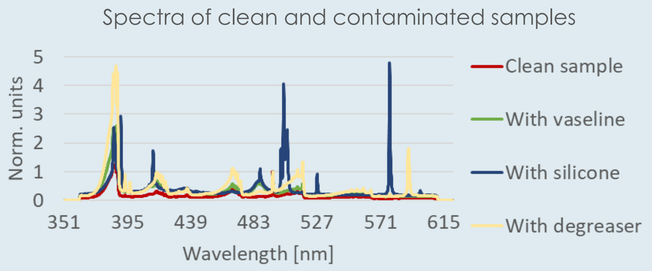
Verification of prepared surface



LIBS tests

LIBS lab setup

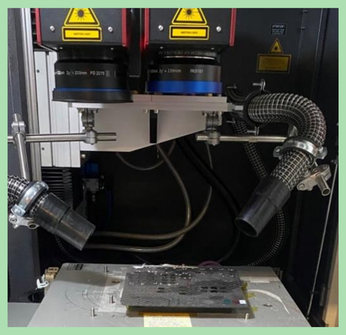




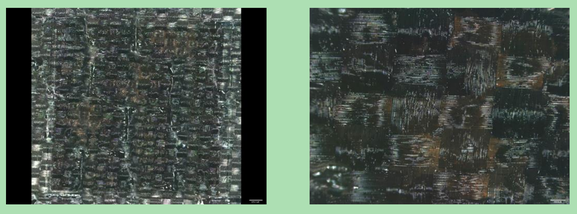
- A lab setup was developed to carry out LIBS tests and to integrate the components
- Discrimination between clean and contaminated samples was demonstrated

Laser cleaning tests

Laser cleaning station



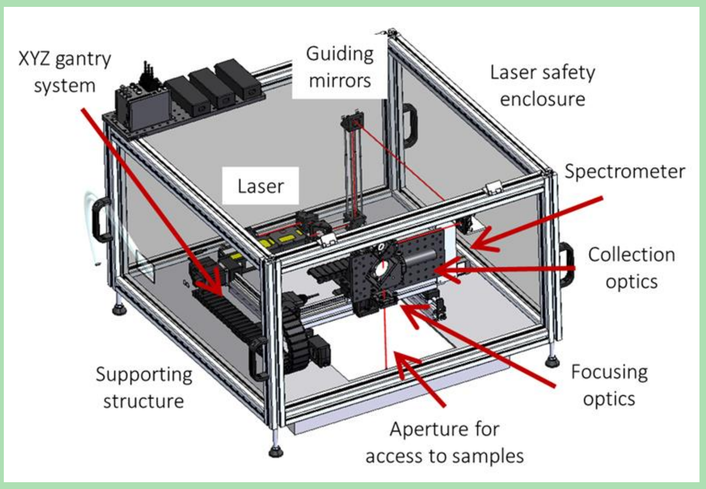
1064nm laser



- Laser cleaning of contaminated samples was investigated using several parameters such as wavelength, power density, etc
- Cleaning with IR (1064nm) laser was achieved

Out-of-the-lab LIBS module

The design-freeze of an out-of-the-lab LIBS system has been reached and the assembly and final validation will take place soon

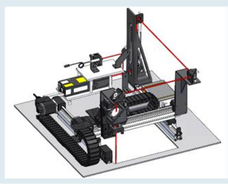


LIBS coupled with laser cleaning

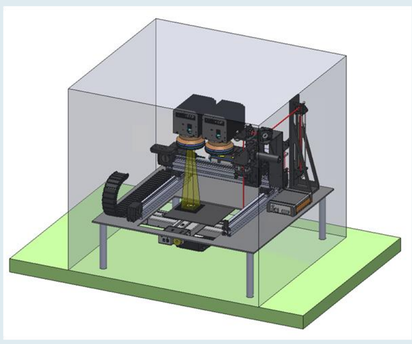
The LIBS module was designed to operate inside the laser cleaning station to enable the combination of both technologies in a single workstation

Laser cleaning station

LIBS module



LIBS module integrated in laser cleaning station



Summary

- Laser cleaning and LIBS-based discrimination between clean and contaminated samples were demonstrated
- A developed out-of-the-lab LIBS module will soon be validated
- A LIBS module concept was conceived and developed to both operate as stand-alone system and integrated within a laser cleaning station

Outlook

- Finalize and validate the LIBS module as stand-alone system and coupled with laser cleaning

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