



Research Potential

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**Fostering AIMEN research potential in laser technology for materials
microprocessing - FaiERA**

Publishable summary

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1 EXECUTIVE SUMMARY

The **strategic objective of the FaiERA project was to reinforce the scientific and technological capacity of AIMEN in the field of laser microprocessing of materials**. More precisely, it aims to upgrade RTD capacity of the Laser Processing Centre of AIMEN in the following Strategic Research Fields (SRFs):

SRF1. Generation of multifunctional surfaces.

SRF2. Generation of biocompatible surfaces.

SRF3. Surface functionalization of textiles and fiber based composites.

SRF4. Laser induced structures for high efficiency semiconductor devices.

In order to accomplish the strategic objective, has accomplished the following actions:

1. Establish strategic partnerships with experienced organizations in the scientific and technological fields related to the Strategic Research Fields.
2. Increase human potential of AIMEN in laser microprocessing by hiring experienced researchers.
3. Increase technological potential of AIMEN in laser microprocessing and its applications by acquiring new equipment.
4. Perform networking and collaborative activities with research centres of excellence.
5. Enhance AIMEN scientific visibility and international reputation through dissemination activities, both to the scientific and the popular audiences.
6. Elaboration of a strategic Plan for Intellectual Property management and protection and innovation capacity building (IPI Plan).

FaiERA has generated the increasing of knowledge of the industry on AIMEN activity and capacity, in sectors with a high growth potential (biomedical, photovoltaic, aerospace, microelectronics).

Besides, this project also has meant a relevant contribution of AIMEN to the development of the Galician smart specialization strategies, implementing laser microprocessing as one of the enabling technologies for a new industrial model based in competitiveness, knowledge, and innovation.

2 PROJECT CONTEXT AND OBJECTIVES

The strategic objective of the FaiERA project is to reinforce the scientific and technological capacity of AIMEN in the field of laser microprocessing of materials. More precisely, it aims to upgrade RTD capacity of the Laser Processing Centre of AIMEN in the following Strategic Research Fields (SRFs):

SRF1. Generation of multifunctional surfaces.

SRF2. Generation of biocompatible surfaces.

SRF3. Surface functionalization of textiles and fiber based composites.

SRF4. Laser induced structures for high efficiency semiconductor devices.

AIMEN is already developing important research activities in the area of laser materials processing and is involved in different R&D projects in these fields. However, to reach its full potential for research and technological innovation, further development is needed. AIMEN has defined a plan which involves a coherent set of specific objectives and relevant actions in order to accomplish the strategic objective, utilize the strengths, and elude the threats as follows:

SO1. Establish strategic partnerships with experienced organizations in the scientific and technological fields related to the Strategic Research Fields.

SO2. Increase human potential of AIMEN in laser microprocessing.

SO3. Increase technological potential of AIMEN in laser microprocessing and its applications.

SO4. Perform networking and collaborative activities with research centres of excellence.

SO5. Enhance AIMEN scientific visibility and international reputation through dissemination activities.

SO6. Elaboration of a strategic Plan for Intellectual Property management and protection and Innovation capacity building (IPI Plan).

In the last decade, the technological requirements of traditional industry have evolved towards knowledge-based processes, high product differentiation, highly efficient processes and new materials. Besides, the market perspectives of AIMEN have been expanded to larger territories and industrial sectors (biomedical, aerospace, etc.), being Laser technology a key enabling technology for accessing all these sectors.

Besides, regional stakeholders participated through their inclusion in the Project Advisory Committee, so that laser microprocessing could be one of the enabling technologies for the smart specialization in Galicia.

3 MAIN S&T RESULTS/FOREGROUNDS

The FaiERa Project work plan was structured as follows:

WP 1 - Project Management.

WP 2 - Strategic partnerships for know-how transfer

WP 3 - Recruitment of experienced researchers

WP 4 - Acquisition of scientific equipment

WP 5 - Networking and collaborative activities

WP 6 - Dissemination activities

WP 7 - Intellectual Property and Innovation capacity Building Plan (IPI Plan).

Hereafter, the performed work is described.

A data base was developed (WP2), dealing with European technological centres, universities, and industrial organizations specialized in laser microprocessing and any other activity related with this field. With some of them, a strategic network was created, involving R&D centres, industrial associations and Galician regional govern institutions. Its role is to support the project objective accomplishment and to maximize the project impact. All these institutions were integrated in the Project Advisory Committee (PAC). Besides, the participating RTD centres collaborated as partnering institutions with AIMEN in research secondments and dissemination activities. Also, some research and dissemination activities have been carried out in collaboration with other industrial partners.

Five expert researchers were recruited (WP3) for the following positions (mainly related with the project Strategic Research Fields):

- Generation of multifunctional surfaces
- Generation of biocompatible surfaces.
- Surface functionalization of textiles and fiber based composites.

- Laser induced structures for high efficiency semiconductor devices.
- Laser processing simulation.

The acquisition of the necessary equipment for the up-grade of AIMEN facilities on laser microprocessing was accomplished (WP4):

- A non-contact microprofiler, more precisely a confocal and interferometric microscope.
- Laser scanning heads and accessories for microprocessing.
- A short-wavelength picosecond laser system.
- A single-mode fibre laser system.
- A five axis micro-positioning system.
- Simulation software licenses.

Some collaboration activities (WP5) were performed with the partnering institutions and industrial partners:

- Some AIMEN personnel visited the partnering research centres.
- Some researchers from the partnering centres visited AIMEN to evaluate their research potential in laser microprocessing.
- Some specific training specific on research topics related to FaiERA SRFs, and initial experiments.
- Research collaborations with the partnering institutions and industrial partners to carry out different experiments on:

Modification of polymer surface wettability

Tribological surfaces by laser micrortexturing

Surface conditioning of copper to improve the continuous wave laser micro welding

Fabrication of microtube array

Fabrication of microneedle array

Fabrication of microfluidic device

High speed titanium micro-drilling by laser

High speed composite micro-drilling by laser

Laser cutting of Carbon Fiber Reinforced Polymers (CFRP)

Graphene patterning and functionalization based on laser-induced multiphoton oxidation

CFRP surface resin ablation and subsequent metallization

Laser microprocessing of surface topographies

- Organization of 2 workshops on “Challenges and Prospects of Multiphoton Polymerization and 3D Laser Lithography” and “Laser Enabled Surface Engineering for Industry: Tailoring Surfaces for High Efficiency”.
- Organization of two international conferences on “Laser Microprocessing: Applications in industry and new progress in R&D” and “Laser Fabrication at the Sub-Micron Range”.

- Some AIMEN personnel visited other research centres and industrial organization, not directly involved in the FaiERA project.
- Two Brokerage events were organized: a “H2020 Laser Manufacturing Brokerage Event” and a “Brokerage Event on Laser Based Micro-manufacturing”.

Besides these collaborations, some dissemination activities (WP6) were carried out:

- Scientific communications to 14 International Conferences Photonics West 2015, and Lasers in Manufacturing 2015.
- 3 publication in peer review journals.
- Some tangible outputs were produced, in order to make the project more visible to general public: Leaflets and posters, publication in AIMEN Bulletin, and Project video (www.youtube.com/watch?v=Lu1YSf3ahU8).

Also, the measures to define the Intellectual Property and Innovation Capacity Building Plan (IPI Plan) were undertaken (WP7):

- The Innovation Management unit was created in AIMEN, with an IP Manager.
- Partnership was established with research institutions with proven experience in IP issues.
- Training activities in intellectual property management through stays in a reference institutions.
- Development of technology transfer schemes
- Development of Best Practices for exploitation of research results

In order to organize all the collaboration activities 7 Project meetings took place with the partnering research centres. Besides, 4 Project Advisory Committee meetings were organized, where the project activities were detailed, and the PAC members gave their recommendations for the successful accomplishment of the FaiERA objectives and Work Plan.

4 POTENTIAL IMPACT. MAIN DISSEMINATION ACTIVITIES AND EXPLOITATION OF RESULTS

The main project results and their related impact are:

PR1. Establish strategic partnerships with experienced organizations in the scientific and technological fields related to the SRFs, in order to establish and expand networks across Europe to support high quality research on laser microprocessing applications, exchange know-how and experiences, and ensure technology and knowledge transfer. This allowed AIMEN to achieve greater capacity for innovation and research, fully exploit the potential of R&D (human resources, facilities, proximity to industry...), as well as a greater presence in the ERA within the Horizon 2020 program.

PR2. Increase human potential of AIMEN in laser microprocessing and the related Strategic Research Fields, by incorporating experienced researchers to lead the activities related to the SRFs, with expertise in the scientific and technological topics necessary for their development (laser microprocessing and ultrafast laser materials processing, laser processing system design, and functional characterization of advanced materials and surfaces). Some of the new incorporations are returned researchers

PR3. Increase the technological potential of AIMEN in laser microprocessing and its applications, by:

- Completing the upgrade of the equipment for laser microprocessing.
- Improving the capabilities of existing equipment for high precision operations.

- Extending the research activities into new and exciting research areas including laser microprocessing of composite materials, multiscale modelling and design of laser processes, and precision laser processing of materials.

- Extending the capacities of AIMEN in materials characterization to a wider spectrum of materials, including ceramics, semiconductors, composites, and biomaterials.

- Extending the capabilities of functional analysis and characterization of functional surfaces to cover the needs of wider spectrum of industries, including aerospace, technical textiles, biomedical, and photovoltaic.

PR4. Perform networking and collaborative activities, aimed to the acquisition of the required level of expertise in laser microprocessing and its applications, and facilitate the knowledge transfer at regional and international level.

PR5. Enhance AIMEN scientific visibility and international reputation through dissemination activities, designed to:

- Increase research quality and recognition, and collaboration with other research centres and institutions enhancing their participation in other research projects. Through this collaboration AIMEN has produced 3 publications in peer review journals and presented 14 communication to international conferences.

- Increase of knowledge of the industry on AIMEN activity and capacity, in sectors with a high growth potential (biomedical, photovoltaic, aerospace, microelectronics).

- Promote laser technology for material microprocessing through web portal, and promotional materials and activities, as well as improve AIMEN presence in trade shows and industry events.

PR6. Elaboration of a strategic Plan for Intellectual Property management and protection and Innovation capacity building (IPI Plan). In order to be able to effectively link research to innovation, a strategy for the full exploitation of the research results is needed. IPI Plan includes concrete measures and management activities to provide AIMEN expertise on IP issues, providing a framework for improvement of IP and know-how protection. This IPI Plan will also allow successful transfer of knowledge acquired in the Strategic Research Fields.

PR7. Further exploitation of the research results coming from the collaboration with the partnering institutions and industrial partners. AIEMN is involved in other 3 H2020 collaborative projects for the further development of this results, and is preparing 1 patent application.

PR8. Strong contribution of AIMEN to the development of the Galician smart specialization strategies, implementing laser microprocessing as one of the enabling technologies for a new industrial model based in competitiveness, knowledge, and innovation.

5 THE ADDRESS OF THE PROJECT PUBLIC WEBSITE

www.faieraproject.eu