

# PROJECT FINAL REPORT

## PICTURES, FIGURES AND TABLES

**Grant Agreement number:** 285775

**Project acronym:** MAC-RTM

**Project title:** Microwave Assisted Curing for Resin Transfer Moulding

**Funding Scheme:** Research for the benefit of specific groups

**Period covered:** from 1/11/2011 to 31/10/2013

**Name of the scientific representative of the project's co-ordinator, Title and Organisation:**

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**Project website** Error! Marcador no definido. **address:** [www.macrtm.eu](http://www.macrtm.eu)

- Description of the main S&T results/foregrounds,

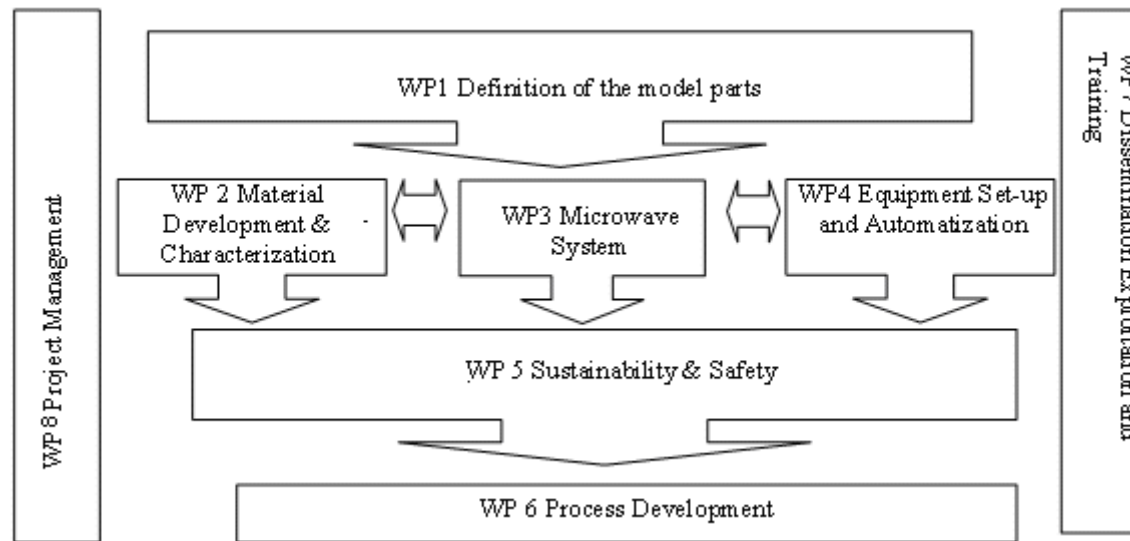
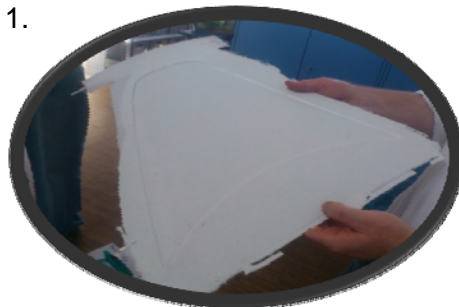
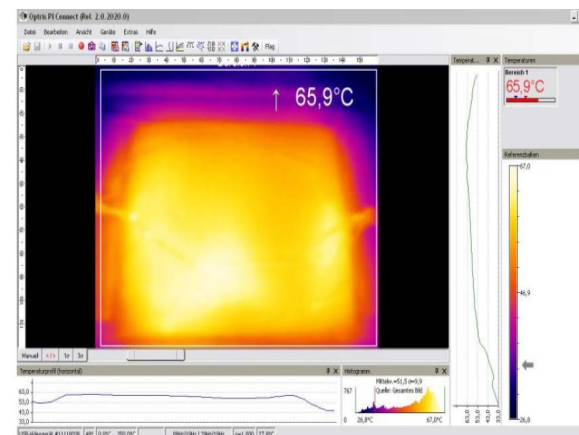
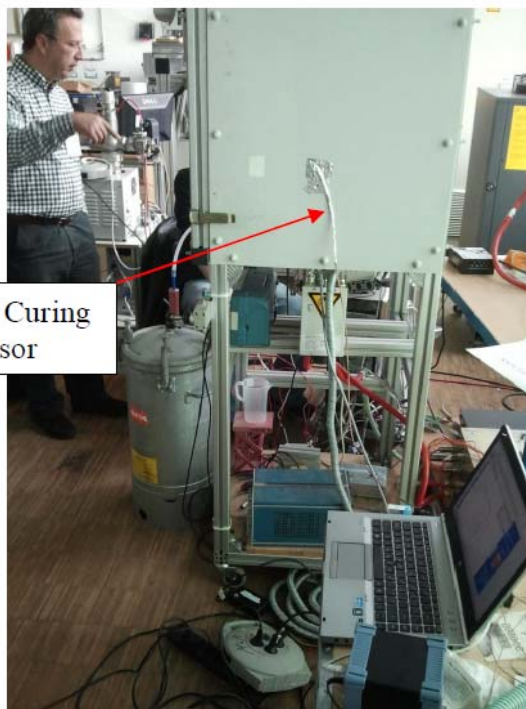
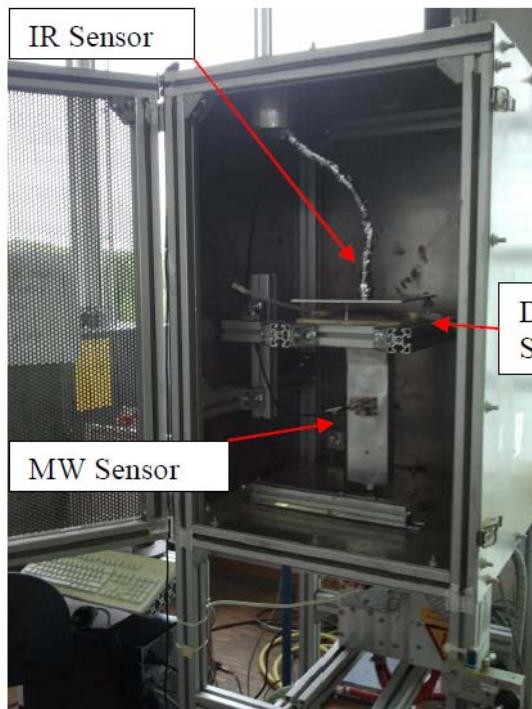


Figure 1. Graphical presentation of the components showing their interdependencies (Pert diagram)

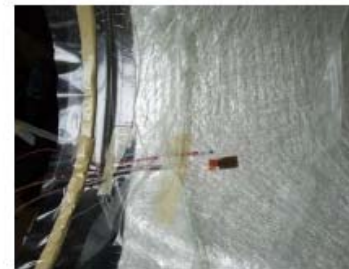
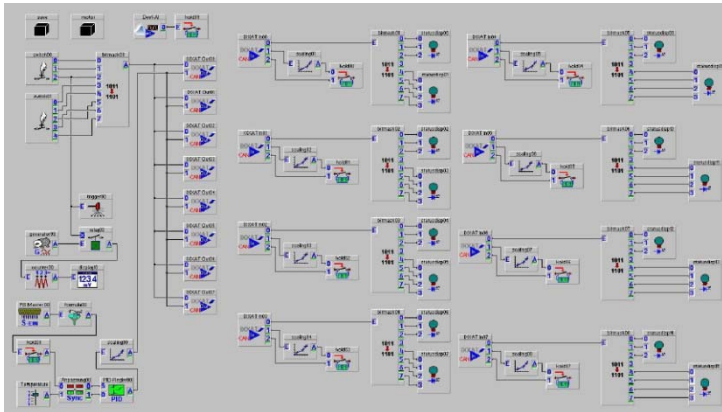
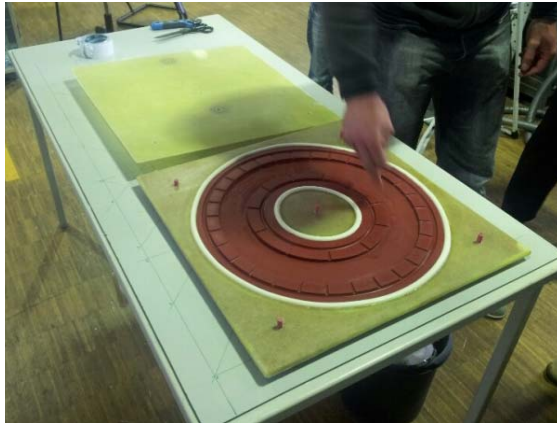
Work Package 1.



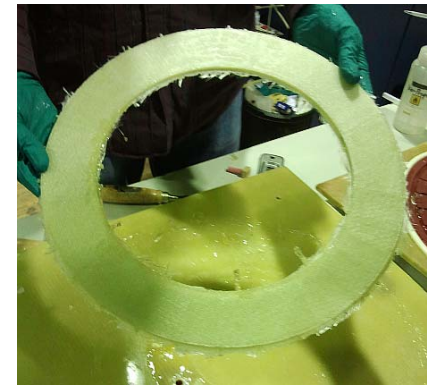
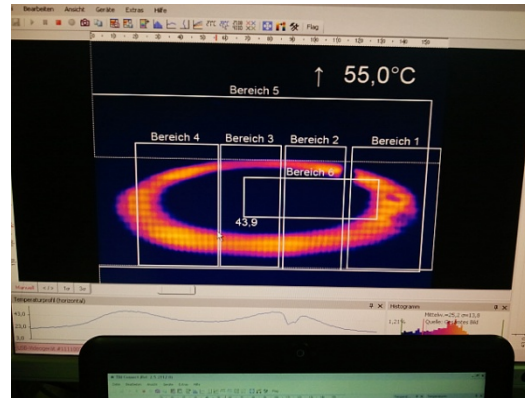
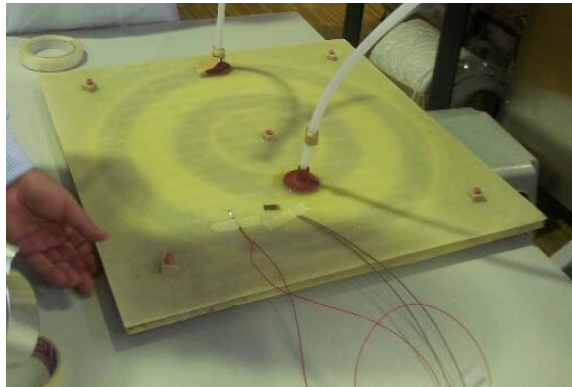
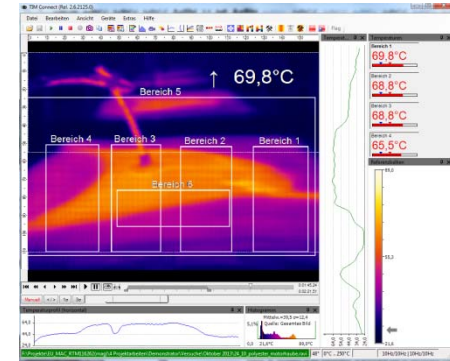
Work Package 3 pictures



Work Package 4 pictures



# Work Package 6 pictures



## Work Package 7 figures

### Partners

The project management structure for MAC-RTM consortium, which consists of 7 SME participants and 2 RTD Performers, has been conceived to ensure competent knowledge, PR and other innovations related activities management, and to enable efficient integration and communication throughout the management chain.

		CLERIUM	AIMPLAS
	SCHMUHL		OMAR
RESOLTECH		XUQUER	
FRAUNHOFER	MEYSI		SYNTHESITES

### Technological Watch

- Use of molded plastics components in smart phones is expected to grow by... NEW - 16/09/2013
- Kick-off of the COALINE project NEW - 14/09/2013
- Frimo and 3D Core develop lightweight construction solutions for... NEW - 11/09/2013
- Partnership to develop cost-effective lightweight construction NEW - 11/09/2013
- Bio-composites Termoplasticos: Mercado, Aplicaciones, Materias Primas y... EVENT - 15/08/2013
- Scalable Microwave Curing System of Long Fiber Reinforced Composites for... TECHNICAL ARTICLE - 14/08/2013
- Structure and properties of aeronautical composites using carbon... TECHNICAL ARTICLE - 10/08/2013
- Resin flow members for a vacuum assisted resin transfer moulding process PATENT - 12/06/2013
- HIGH-BIAS WEIGHT CARBON FIBER SHEET FOR RTM PROCESS, AND RTM PROCESS PATENT - 25/06/2013

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### Intranet

In this section you can find all confidential information related to the project. See the project plan and technical and administrative documentation.

» View Intranet »

### AIMPLAS and Fraunhofer-ICT patents applications

The invention provides for a method for producing plastics moldings having a cured plastics matrix

The invention provides for a method for heating materials being capable of absorbing high-frequency electromagnetic radiation

The invention provides for a method for heating materials by means of absorbing high-frequency electromagnetic radiation, in particular microwaves, by means of insulating said materials with high-frequency electromagnetic radiation. In order to achieve an essentially consistent heating of the material and, in particular, to avoid hot spots in the material, the high frequency electromagnetic radiation...

The research leading to these results has received funding from the European Community's Seventh Framework Programme FP7/2007-2013 under grant agreement n° 282557

MAC-RTM project website

## Partnership

The Project Consortium consists of 7 SMEs and 2 RTD performers. The main role for each consortium partner could be summarized in the following structure:

### Additional information

[www.macrtm.eu](http://www.macrtm.eu)

### Contact

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The investigation leading to these results has received funding by the EU Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 282575.

## Microwave Assisted Curing for Resin Transfer Moulding

Examples of RTM parts from XUQUER and SCHMUHL

- 1.- Specification of a model part
- 2.- Assessment of resins for alternate curing technology during RTM and RTM-Light processes.
- 3.- Development and optimisation of the alternate curing technology.
- 4.- Industrial sale of the new technology

## The project

MAC-RTM project aims to develop an alternative microwave-assisted curing (MAC) technology for thermoset materials (polyester, vinyl ester, and epoxy resins) with improved flexibility and more cost and energy effective than current curing technologies.

The project MAC-RTM will cover the development of an innovative system for curing resins through microwaves.

This promising technology will be optimized by using powerful simulation tools of filling and interaction between the electromagnetic field and the resin.

## Objectives

The developments in the project MAC-RTM will allow the adaptation to resins processed by RTM and RTM light to microwave curing process in order to produce medium-volume components with the following advantages:

- Reduction of the cycle time by 40 %, leading to increase productivity and efficiency.
- Decrease energy consumption by 70 %.
- Reduce styrene emissions by 90 % in comparison with open-mould processes.
- Increase polymerization level by 100 %.
- Reduce mould costs by 30 %.
- Reduce material usage, since parts over-sizing is not necessary.

The MAC - RTM project will contribute to enhance the competitiveness of the European SMEs in the global market with the development of an integrated system that is technically innovative, environmentally friendly, and economically viable.

## Partners

## Funding:

The research has duration of 2 years, being its completion expected for October, 2013. The project of the Capacities programme "Research for the Benefit of SMEs", has a budget of nearly € 1.1 million.

Flyer front and back

Work Package 7 figures

**MAC-RTM**  
Microwave Assisted Curing for Resin Transfer Moulding

**INTRODUCTION**  
MAC-RTM is a European Collaborative Project funded under the seventh frame program coordinated by AMPLIAS. The Project aims to develop an alternative microwave-assisted curing (MAC) technology for thermoset materials (polyester, vinyl ester and epoxy resins) with improved flexibility and more cost and energy effective than current curing technologies. The project MAC-RTM will cover the development of an innovative system for curing resins through microwaves. This promising technology will be optimized by using powerful simulation tools of interaction between the electromagnetic field and the resin.

**OBJECTIVES**  
The developments in the project MAC-RTM will allow the adaptation of resins processed by RTM and RTM-light to microwave curing process in order to produce multi-variant components with the following advantages:  
 → Reduction of the cycle time by 40%, leading to increase productivity and efficiency.  
 → Decrease energy consumption.  
 → Reduce styrene emissions by 90% in comparison with conventional processes.  
 → Increase polymerization level by 100%.  
 → Reduce mould costs by 30%.  
 → Reduce material usage, since parts over-curing is not necessary.

**PROJECT SCHEME**  
Definition of the model parts  
 Material Development & Characterization ↔ Microwave System ↔ Equipment Set-up and Automation  
 Sustainability & Safety  
 Process Development

**INNOVATIONS**  
 1. Mould development - modification of polymers by varying the fillers, fibers or components to manufacture cost effective, wear resistant and microwave-suitable mould.  
 2. Selection of the microwave-absorbent additives.  
 3. Development of a microwave system for reproducible heating with a control unit based on a change in the dielectric function of the resin along curing.  
 4. Integration of microwave system in the new RTM mould taking into account heat transfer, sensor integration, homogeneous heating, reusability in different mould and geometries...  
 5. Evaluations of the microwave accelerated RTM process to control the curing, reduce the cycle time and evaluate the mechanical and chemical properties of the produced components.

**PARTICIPANTS**  
 AMPLIAS, Ceriumi, Fraunhofer, CMyst, rtsultech, SOHNHIL, Synthesizer, ANQUEP

**FUNDING:** The research has duration of 3 years, being its completion expected for October, 2013. The project is part of the Capacities programme "Research for the Benefit of SMEs", with a budget of nearly 4.13 million. Acknowledgement: The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement number 285275.

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MAC-RTM project poster



(a)



(b)

Examples of Dissemination activities: EUROMAT 13 (a) and ICCST-9 (b)

- Address of the project public website, consortium and relevant contact details.

<http://www.macrtm.eu/>



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Beneficiary Number	Beneficiary name	Beneficiary short name	Beneficiary logo	Type	Country
1 (Coordinator)	Asociación de Investigación de Materiales Plásticos y Conexas	AIMPLAS	 AIMPLAS INSTITUTO TECNOLÓGICO DEL PLÁSTICO	RTD	ES
2	CLERIUM	CLERIUM	 Clerium	SME	NL
3	Schmuhl Faserverbundtechnik GmbH & CO KG	SCHMUHL	 SCHMUHL	SME	DE
4	RESOLTECH	RESOLTECH	 résoltech ADVANCED TECHNOLOGY RESINS	SME	FR
5	Alberto Mora Galiano	OMAR	 INDUSTRIAS OMAR	SME	ES



6	Talleres Xúquer SL	XUQUER		SME	ES
7	Material Eléctrico y Suministros Industriales SL	MEYSI		SME	ES
8	Synthesites Innovative Technology	SYNTHESITES		SME	GR
9	Fraunhofer-Gesellschaft zur Förderung der angewandten Forshung e.V.	FRAUNHOFER		RTD	DE

