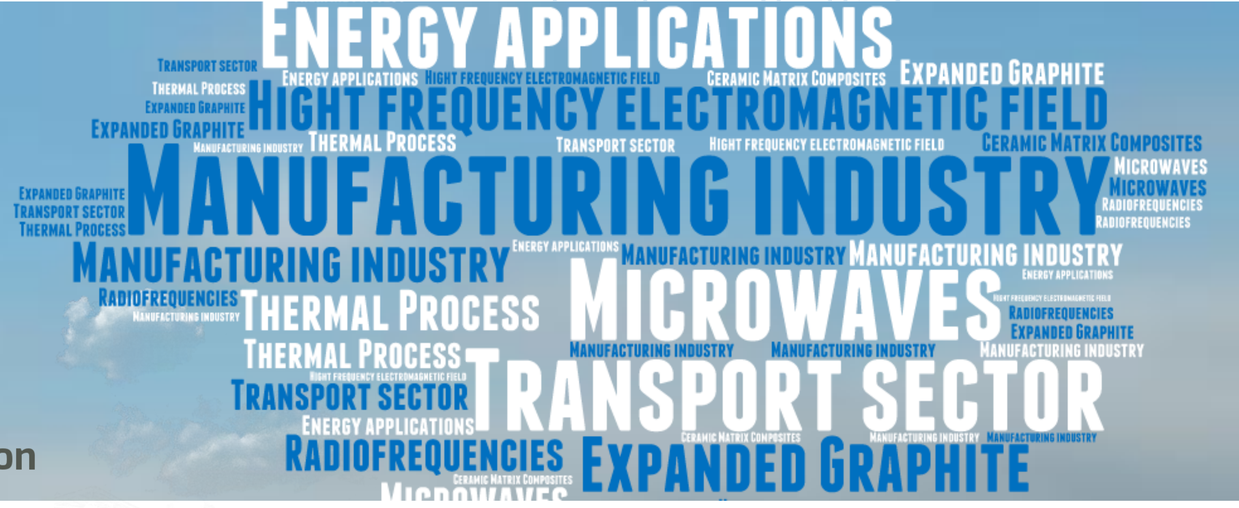
HELM

High-frequency ELectro-Magnetic technologies for advanced processing of ceramic matrix composites and graphite expansion



CONCEPT

Advanced ceramic materials represent the latest and most promising solutions for high temperature applications in the *manufacturing industry*, in the *transportation sectors* and for new demanding electrotechnical applications (such as *energy harvesting*).

Lightweight fibre reinforced ceramic composites are one of topical priorities of the **European Technology Platform EuMAT** and a strategic issue of the **EC Research Roadmap on Materials**.

Non-oxide **CERAMIC MATRIX COMPOSITES** (CMCs) —carbon (C) or silicon carbide (SiC) fibre reinforced composites have *attractive high temperature properties*, such as creep resistance and microstructural stability; they also have *high thermal conductivity* and *low thermal expansion*, leading to excellent *thermal stress resistance.*

EXPANDED GRAPHITE (EG) has also attracted increased market attention. EG outperforms non-expanded graphite and other conductive fillers in terms of *thermal and electrical conductivity.*

OBJECTIVES

HELM will include **three RTD pillars** dedicated to specific manufacturing technologies.

P1: Chemical Vapour Infiltration-CVI

Hybrid thermal/MW assisted CVI technology to achieve:

- a factor ten in *manufacturing time reduction* of CMCs
- *cost-effective process* route to build up the SiC matrix in 2D or 3D fibre performs.

P2: Liquid Silicon Infiltration-LSI, Graphite Expansion-GE

MW furnaces capable respectively for LSI and GE manufacturing:

- overcome the limitations of existing MW technologies
- trimming down *process time* (between 15% to 60%) and
- *energy consumption* (of about 50%).

P3: Polymer Impregnation and Pyrolisis-PIP

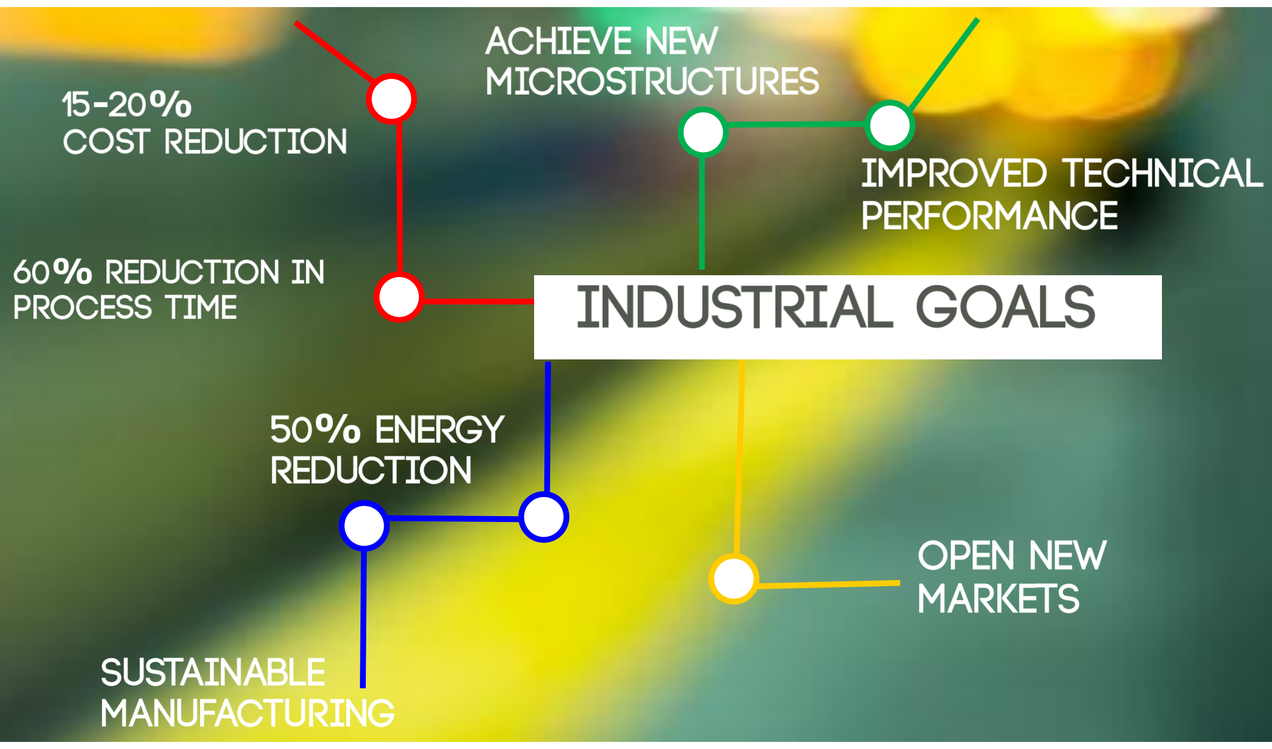
Pyrolisis/PIP processes based on EM heating. The approach will be based on three different techniques: conventional MW heating, advanced MW heating (*frequency combination)* and RF.

INDUSTRIAL GOALS

HELM is absolutely **strategic from the industrial point of view**, as industry and market needs are the main drivers of development and integration of the proposed MW/RF thermal processing technologies.

HELM takes into consideration the **most significant market niches** for C/SiC or SiC/SiC composites and EG.

CMCs and EG are advanced materials where Europe has outstanding leadership at global level; indeed some of those leaders are involved in HELM**.** Nevertheless **European industries need new technical solutions** in order to stay competitive within a market that requires **HIGHER PERFOR[illegible]oducts at lower cost.**

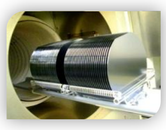


AEROSPACE MATERIALS

HERAKLES leads the design and production of solid rocket motors for missiles and space launchers, producing **C/C, C/SiC and SiC/SiC composites.**

AIRBUS GROUP is leader in aerospace and defense. PIP manufactured C/SiC is currently used in Airbus Group for Thermal Protection Systems and Hot Structures.

REFRACTORY MATERIALS



SCHUNK is leader in the field of CVI and CVD processes for graphites and composites.

SKT main business is the manufacture of CMC-structural components for industrial plants for polysilicon production.

CARBON-CERAMIC BRAKE DISKS

BSCCB, a joint venture between Freni Brembo SpA and SGL Brakes GmbH, is a world leader in the sector of carbo-ceramic rotors manufacturing via Liquid Silicon Infiltration (LSI) for high performance brake systems.

ANTIBALLISTIC MATERIAL

PETROCERAMICS, with a key position in the and development of new ceramic materials, has experience in the production of antiballistic ceramics made of carbides, nitrides and carbon pre-forms densified via Liquid Silicon Infiltration (LSI) process.

SiC FOAMS

ERBICOL produces porous ceramics made of silicon infiltrated SiC for components working in high temperature, harsh environments, where materials with high thermal conductivity, thermal shock resistance and corrosion resistance are needed.

EXPANDED GRAPHITE

IMERYS is part of the French Group IMERYS being a world leader for industrial minerals. IMERYS produces high quality expanded graphite for energy applications, electrochemical storage devices, fuel cells and solar ovens.

PROJECT DETAILS

Grant Agreement No.: 280464

Programme acronym: FP7-NMP

Topic: *NMP.2011.4.01 New technologies based on physical processing of materials for mechanical or electrotechnical applications*

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End date: May, 31st 2016

EU contribution: 7,151,000 €

Total cost: 10,285,626 €

PARTNERS

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