European Commission

This fiche is part of the wider roadmap for cross-cutting KETs activities

'Cross-cutting KETs' activities bring together and integrate different KETs and reflect the interdisciplinary nature of technological development. They have the potential to lead to unforeseen advances and new markets, and are important contributors to new technological components or products.

The complete roadmap for cross-cutting KETs activities can be downloaded from:

http://ec.europa.eu/growth/industry/key-enabling-technologies/eu-actions/ro-ckets

Potential areas of industrial interest relevant for cross-cutting KETs in the Manufacturing and Automation domain

This innovation field is part of the wider roadmap for cross-cutting KETs activities developed within the framework of the RO-cKETs study. The roadmap for cross-cutting KETs activities identifies the potential innovation fields of industrial interest relevant for cross-cutting KETs in a broad range of industrial sectors relevant for the European economy.

The roadmap has been developed starting from actual market needs and industrial challenges in a broad range of industrial sectors relevant for the European economy. The roadmapping activity has focused on exploring potential innovation areas in terms of products, processes or services with respect to which the cross-fertilization between KETs can provide an added value, taking into account the main market drivers for each of those innovation areas as well as the societal and economic context in which they locate.

Taking the demand side as a starting point, cross-cutting KETs activities will in general include activities closer to market and applications. The study focused on identifying potential innovation areas of industrial interest implying Technology Readiness Levels of between 4 and 8.

MA.1.4: Automated production of thermoset and thermoplastic composite structures/ products

Scope:

Combinations of methods (automated production, out-of-autoclave production, press forming and welding, laser cutting and joining) and materials (resins and polymer matrix combinations, curable, reusable and recyclable thermoplastics) for weight reduction and novel constructs.

Demand-side requirements (stemming from Societal Challenges) addressed:

Depending from the application or the type of processes used for production, manufacturing and automation can especially contribute to tackle the following societal challenges:

- Secure, clean and efficient energy
- Climate action, resource efficiency and raw materials

Demand-side requirements (stemming from market needs) addressed:

- Provide for rapid and flexible production capabilities to match supply with volatile demand of today's rapidly changing markets
- Flexibly integrate design specifications into efficient operational routines by keeping a comparable throughput time in different configurations
- Provide for fast product/service systems able to combine rapid and flexible production capabilities with enhanced product design capabilities and exploit minimal distribution lead-times to match supply with volatile demand of today's rapidly changing markets
- Provide for the production of high-quality products
- Provide for the production of durable products
- Provide for alternative manufacturing approaches coping with the need of utilizing new and advanced materials in products, adding functionalities to products, dealing with complex structures and shapes

Specific technical/industrial challenges (mainly resulting from gaps in technological capacities):

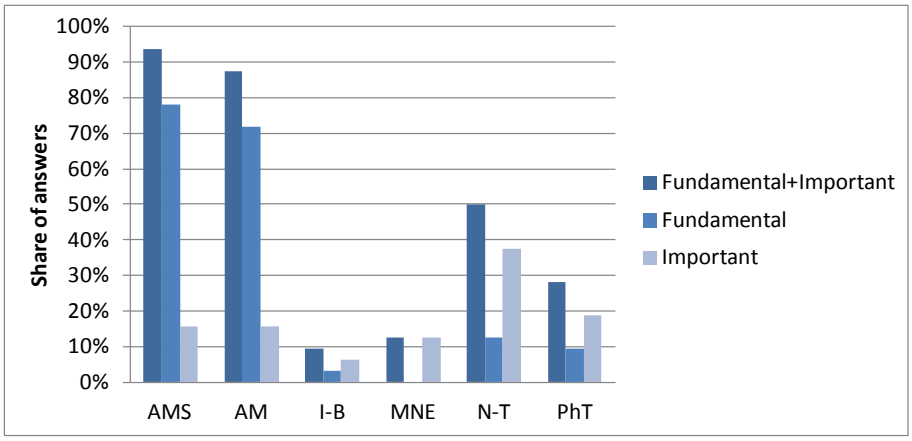
- Development of new manufacturing methods and concepts which will help to reduce cost and exploit the unique properties of composites
- Adaptation of processing techniques and procedures towards automated production
- Enhancement of the performance of materials such as resins as well as fibres to be applied as reinforcement in matrix materials to make the composite material stiffer but lightweight and with anisotropic properties
- Improvements in the reuse and recycling of composites

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the development of more advanced processes for the automated production of thermoset and thermoplastic composite structures/products along with the development of enhanced materials such as high performance resins or fibres to be applied as reinforcement in matrix materials.

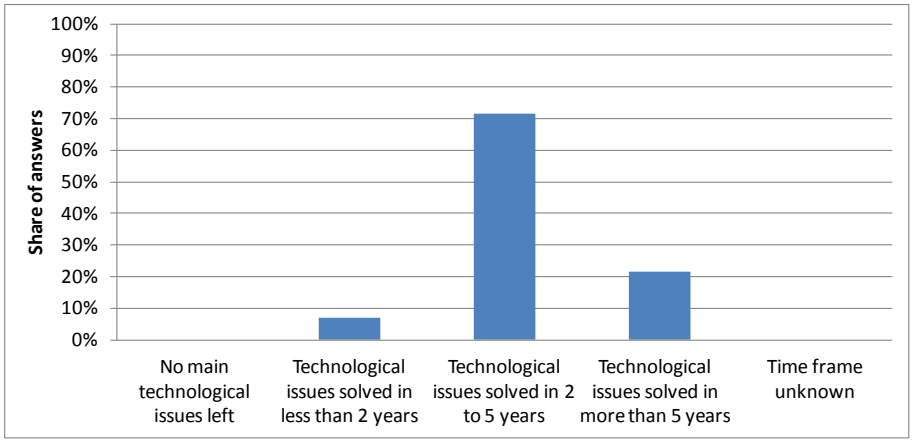
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong interaction of KETs with respect to this Innovation Field, with either fundamental or important contribution mainly by the following KETs:

- Advanced Manufacturing Systems (AMS)
- Advanced Materials (AM)



Timing for implementation:

According to the majority of KETs experts' opinions (whose result is depicted in the below bar chart), desk research, and in line with the KETs-related patenting activity in this field, it is considered that the main technological issues holding back the achievement of cross-cutting KETs based products related to this Innovation Field could be solved in a time frame of 2 to 5 years, yet consensus by experts indicates also greater periods being necessary:



Hence, depending on the specific technical and/or industrial challenges holding back the achievement of cross-cutting KETs based products related to this Innovation Field, the provision of support in the short term should be taken into consideration within this framework. Yet, as evidenced during some of the interviews and workshops carried out throughout the study, depending from the size of the products to be processed, greater periods might be necessary to achieve fully automated production of thermoset and thermoplastic composite structures/products if specific large area applications would need to be addressed (such as wind turbines or airplanes).

Additional information according to results of assessment:

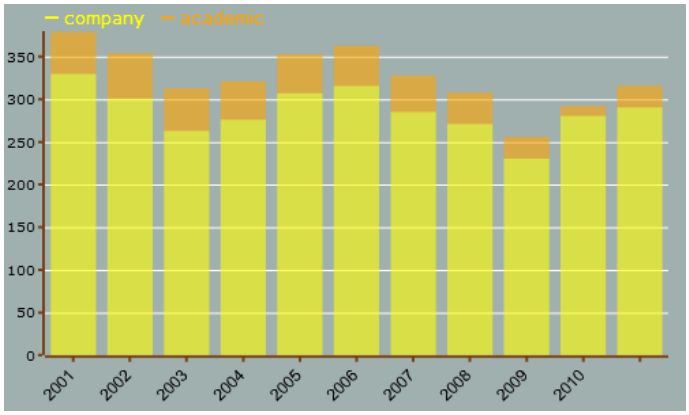
- ***Impact assessment:***
  - The composites industry serves a wide range of different industrial applications. As a result, the European market for, especially, fibre-reinforced composites will reach 1.29 million tonnes by the end of 2013. Smithers Rapra forecasts an increasing growth rate over the next five years, reaching 1.55 million tonnes by 2018 (Source: Smithers Rapra; RAPRA Publishing, The Future of Fibre-Reinforced Thermoplastics in Europe: Market Forecasts to 2018).
  - In Europe, above all, the German composites industry has expanded its share of total production volume becoming the most important manufacturing country in this sector in Europe. The reasons for this are often stated as the high quality of its manufactured products and excellent standard of service offered. Innovation, carefully targeted development and refinement and the constant urge for renewal are reasons why German companies (including those in the composites sector) are able to compete

successfully in the international market. Highly developed sectors that are particularly strong in Germany, such as the automotive, mechanical engineering and chemical industries are continuing to generate high levels of exports even in difficult economic times.

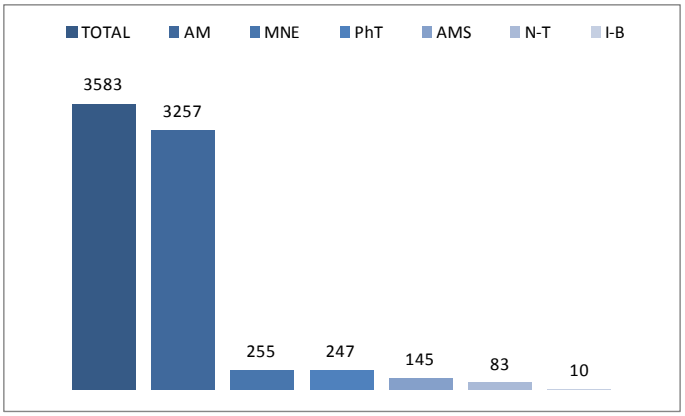
- Source: AVK, Composites Market Report 2013 - Market developments, trends, challenges and opportunities, 2013

➢ ***Results of patents scenario analysis:***

- 3583 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Oscillating trend curve (number of patents per year) with downturn in 2009 and then recovery
- Highest share of industrial applicants:



- Patents by KET(s):

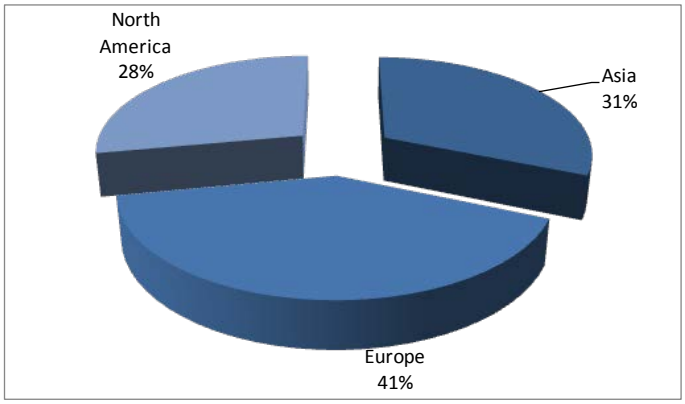


- Patents by KET(s) and relevant combinations of KETs:

KET(s)	*Number of patents*
AM	3257
AM / IBT	6
AM / IBT / PhT	1
AM / MNE	119
AM / MNE / N-T	1
AM / MNE / PhT	22
AM / N-T	70
AM / N-T / PhT	4
AM / PhT	135
AMS	145
AMS / AM	34

KET(s)	*Number of patents*
AMS / AM / MNE	3
AMS / AM / MNE / PhT	2
AMS / AM / N-T	1
AMS / AM / PhT	2
AMS / MNE	9
AMS / MNE / PhT	2
AMS / N-T	2
AMS / PhT	4
IBT	10
IBT / PhT	1
MNE	255
MNE / N-T	5
MNE / N-T / PhT	1
MNE / PhT	57
N-T	83
N-T / PhT	7
PhT	247

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection: