



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 Chemical Processes, Chemicals, Chemical Products and Materials 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.

CH.2.4: Coatings and surfaces with high scratch and/or corrosion resistance, good weatherability and/or with self-repairing capabilities

Scope:

Long-lasting coatings and surfaces with high scratch and/or corrosion resistance, good weatherability as well as coatings and surfaces with self-healing, self-repairing or self-replicating properties.

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

- Indirectly tackle challenges such as “climate action, resource efficiency and raw materials”, “smart, green and integrated transport” and “secure, clean and efficient energy” thanks to contributing higher performing materials for various applications that are key to the achievement of the aforementioned challenges

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

- Production of high performing materials with improved functionalities

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

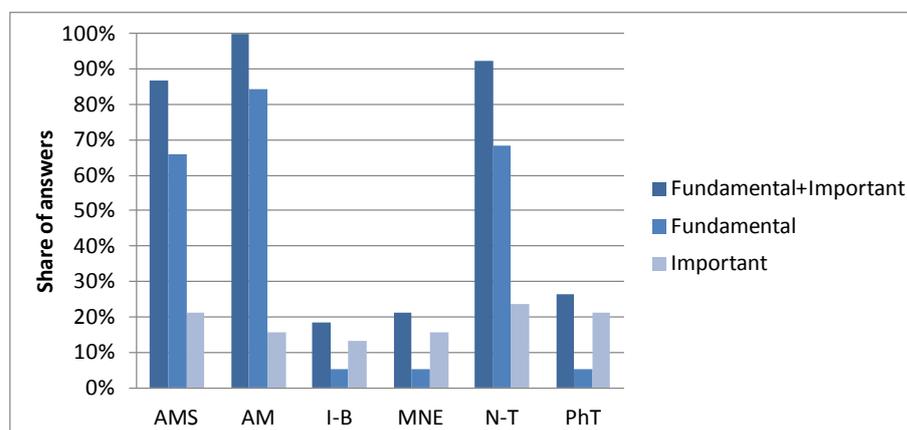
- Understanding and prediction of the relationships among chemistry, microstructure and material properties/ performance
- Control of functional properties and performance through synthesis and processing
- Lifetime prediction

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, long-lasting coatings and surfaces with high scratch and/or corrosion resistance, good weatherability and/or with self-repairing capabilities, thanks to adjusting chemistry, microstructure and material properties/performance and the precise control of their functional properties and performance through specialized synthesis and processing.

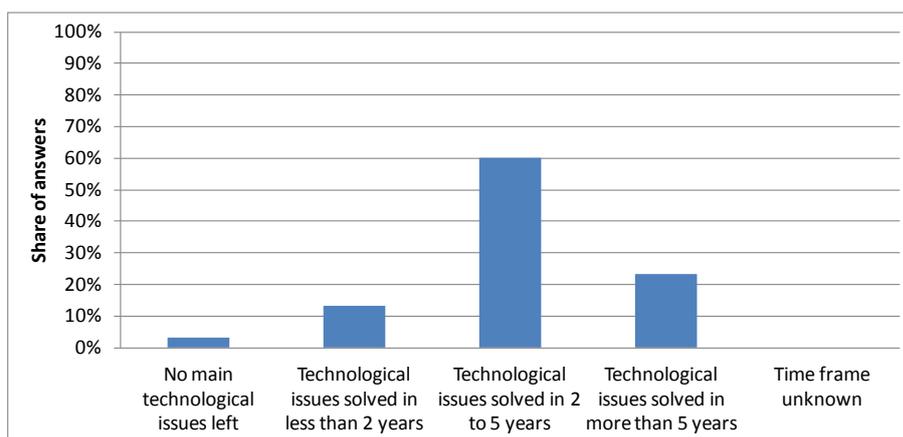
To this aim, the combination of KETs experts' opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong 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)
- Nanotechnologies (N-T)



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:



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.

Additional information according to results of assessment:

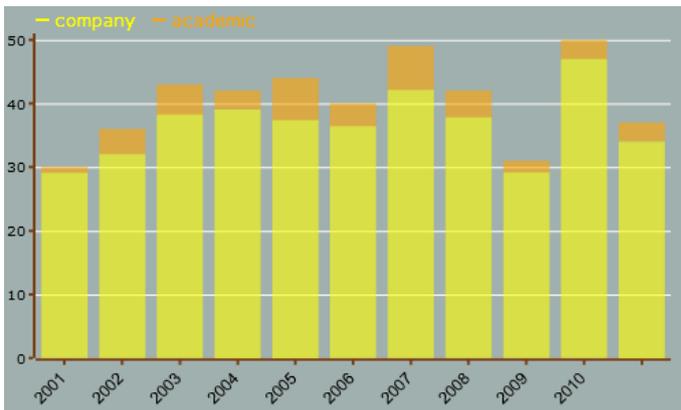
➤ **Impact assessment:**

- Along with paints and finishes, protective coatings are widely used in many industrial sectors (transport, construction and other various industrial applications). Coats for the various applications must maintain their properties over long periods in the face of degradation caused by damage or environmental exposure.
- Exterior clearcoats and topcoats, the outermost coatings used for various applications importantly in the transport sector, including in aircrafts and vehicles, must maintain properties such as smoothness of surface finish (for aircrafts) and clarity and gloss (for vehicles), though they may be subject to damage caused by numerous elements, including environmental fallout; exposure to ultraviolet radiation from sunlight; exposure to high relative humidity at high temperature; and defects made by impact from small, hard objects resulting in chipping. Yet they can be formulated to minimise scratches and environmental exposure degradation.
- While environmental regulations are driving the shift to low Volatile Organic Compound (VOC) products such as waterborne or powder coatings, the market demand for advanced paints and coatings technology is increasing. As a result, advanced coating solutions are being developed and provided by paints and coatings companies to vehicle and aircraft manufacturers. Within this framework, Europe is the base for important international paints and coatings producing companies such as Akzonobel, Arkema, BASF, Bayer, Clariant, Solvay, to name a few (Source: ResearchandMarkets, Automotive Paints Market by Coat Type, Technology, Texture Type, Vehicle Type & Geography - Global Trends & Forecast to 2018, September 2013).
- Global demand for vehicles is increasing, specifically for passenger cars and light commercial vehicles, and global vehicle production reached 84.1 million units in 2012. Analogously, global demand for aircrafts is increasing. Due to the increase in vehicle as well as aircraft production, paints and coatings consumption also increased in 2012. The global market for paints and coatings is also expected to grow at a promising rate in the next years. Within this framework, while Europe constituted the largest paints and coatings market as well as producer in 2007, it then left its position to the Asia-Pacific region, despite maintaining high volumes in terms of both market and production (Source: ResearchandMarkets, Automotive Paints Market by Coat Type, Technology, Texture Type, Vehicle Type & Geography - Global Trends & Forecast to 2018, September 2013).
- Also in the construction industry paints, finishes and coatings find important applications. In this case, they require good weatherability, impermeability, and, in case of steelworks, most importantly corrosion resistance.

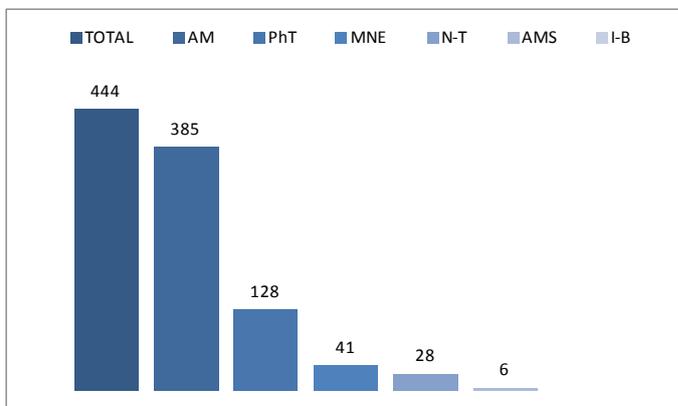
- The European construction paints and coatings market size was worth 10 billion Euro in 2011. Market size increased by 1.9% in 2011 over 2010, after recording two consecutive years of decline in 2009 and 2010. Europe also recorded an increase in demand by 2.1% in 2011 over 2010 despite registering a decline in volume in the previous year, which can be attributed to the significant reduction of construction activities across all European countries due to the global economic slowdown. The market recovery in 2011 came about due to the positive growth in market size of paints and coatings across all European countries except Spain and the UK. In 2011, Poland recorded the highest annual growth of paints and coatings market size in Europe (6.8%). The high growth in Poland is due to the country's persistent housing deficit which encouraged residential construction. The other European countries recorded negative growth rates in the market size, with the UK declining the most (Source: Timetric, Global Construction Paints and Coatings - Market Opportunities and Business Environment, Analyses and Forecasts to 2016, December 2011).
- The aerospace and defence sector have widely implemented advanced coatings to exploit materials performance. This is also due to the fact that the requirements typically needed in the defence sector are much more challenging than in other fields, as for example the need for lightweight, thermal stability, high melting point, high thermal conductivity, oxidation resistance, complex shapes. This shows that the potential for dual use applications is very high, particularly from the aerospace & defence to other civilian sectors.

➤ **Results of patents scenario analysis:**

- 444 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Stable trend curve (number of patents per year)
- Highest share of industrial applicants:



- Patents by KET(s):

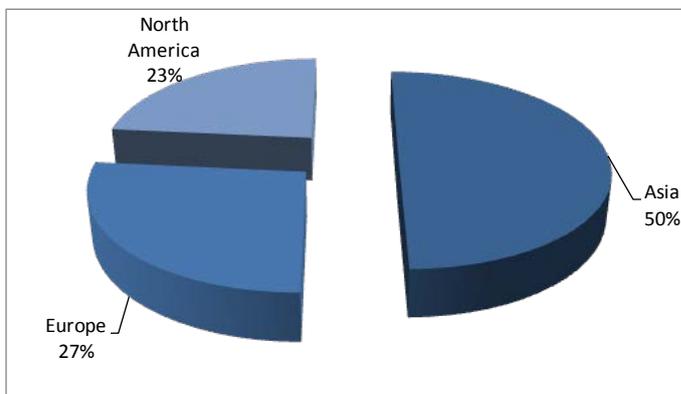


- Patents by KET(s) and relevant combinations of KETs:

KET(s)	Number of patents
AM	385
AM / MNE	21

<i>KET(s)</i>	<i>Number of patents</i>
AM / MNE / N-T	3
AM / MNE / N-T / PhT	1
AM / MNE / PhT	12
AM / N-T	24
AM / N-T / PhT	4
AM / PhT	84
AMS	6
AMS / AM	1
AMS / AM / PhT	1
AMS / MNE	2
AMS / MNE / PhT	1
AMS / PhT	2
MNE	41
MNE / N-T	4
MNE / N-T / PhT	2
MNE / PhT	23
N-T	28
N-T / PhT	5
PhT	128

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection:

