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.2.6: High mechanical, chemical and optical properties thin glass for low weight, high performance applications

Scope:

Cost-effective, high mechanical, chemical and optical properties thin glass layers for low weight, high performance applications, such as to improve or replace costly coatings and surface treatments whilst maintaining mechanical and chemical properties (purity, anti-reflectiveness, spectral behaviour, anti-fog, anti-dust, etc.).

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):

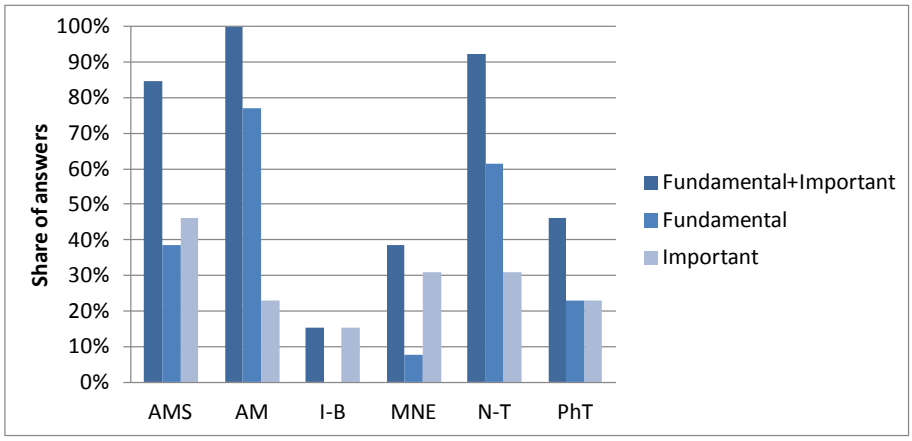
- Development of cost-effective glass production processes that enable to improve or replace costly coatings and surface treatments whilst maintaining mechanical and chemical properties (purity, anti-reflectiveness, spectral behaviour, anti-fog, anti-dust,etc.)
- Development of high strength flat glass enabling large panels including for high insulating properties vacuum glass surfaces
- Development of solutions that stabilize the production process so as to minimize thickness variations and allow a reduction of design margins
- Development of energy efficient thermal toughening of very thin glass layers, eventually through employing liquid or a gas/liquid phase as a cooling medium
- Development of chemical high throughput hardening processes to produce scratch and shock resistant ultra-thin glass for sensitive screens (tablet-like)

Contribution by cross-cutting Key Enabling Technologies:

In respect to this Innovation Field, the integration of KETs could contribute to the further development of high mechanical, chemical and optical properties thin glass for low weight, high performance applications, including thanks to the development of cost-effective thin glass production processes that enable to improve or replace costly coatings and surface treatments, including the development of chemical high throughput hardening processes to produce scratch and shock-resistant ultra-thin glass for sensitive screens (tablet-like).

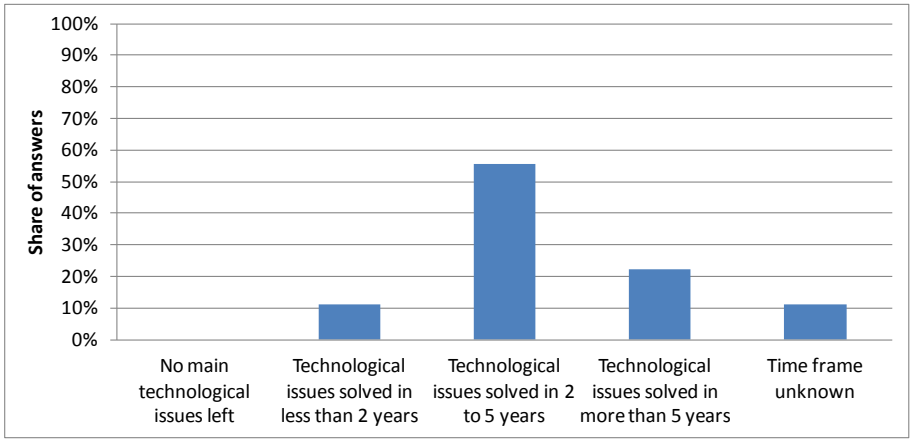
To this aim, the combination of KETs experts’ opinions collected through the dedicated survey (whose result is depicted in the below bar chart), the examination of KETs-related patenting activity in respect to this Innovation Field, and desk research activities, have allowed identifying a rather strong 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:

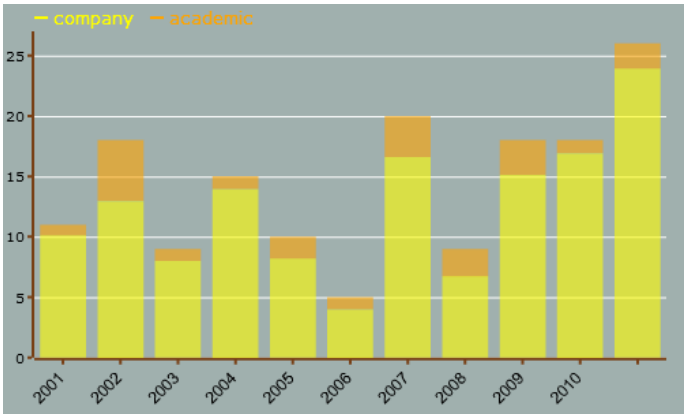
- ***Impact assessment:***
  - The global glass industry generates about 55 billion Euro in annual revenue, dominated by the building construction market. Top exporters include Belgium, China, France, Germany, Japan, and the US. World demand for flat glass is forecast to rise of 7.1% per year through 2016 so that the global market value of fabricated flat glass is forecast to reach 67 billion in 2016. The Asia/Pacific region, which accounted for 60% of global flat glass demand (on a square metre basis) in 2011, will continue to post the fastest gains through 2016. The global market for flat glass in 2009 was approximately 52 million tonnes, representing a value at the level of primary manufacture of around 22 billion Euro. This market has historically been growing in volume terms at 4-5% a year.
  - Fabricated flat glass demand will also benefit from rapid growth in sales of energy efficient products such as solar control, insulation, and low-E glass. Moreover, the solar energy market, which was hurt by recent global economic weaknesses, will take off once again. It should be noted, however, that demand for flat glass used in solar energy applications totalled just around 120 million square metres in 2011, so being a niche market with respect to the greater construction market.
  - Thin glass classifying as special glass has instead a high added-value linked to its intense technological content. This sector regroups a large range of products such as lighting glass, glass tubes, laboratory

glassware, glass ceramics, heat resistant glass, optical and ophthalmic glass, extra thin glass for the electronics industry (e.g. Liquid-crystal display (LCD) panels, photovoltaics (PVs)) and radiation protection glasses. Special glass only micrometers in thickness can be manufactured as a continuous ribbon and then be rolled up at Schott, Germany. Although thin glass is already available on the market, Schott claims to be the first manufacturer capable of producing it in a thickness of only 25 microns. Ultra-thin glass will open up a number of applications. This extremely thin and flexible glass can replace materials that offer flexibility and are durable, yet cannot offer the outstanding physical and chemical properties of glass, such as plastics, for instance, which in contrast to glass are not gas-tight and therefore do not offer enough protection for electronic components from environmental influences. Special glass, on the other hand, stands up to high temperatures and offers long-term stability, is durable, highly resistant to chemicals, and resists diffusion. Furthermore, it also protects against UV radiation.

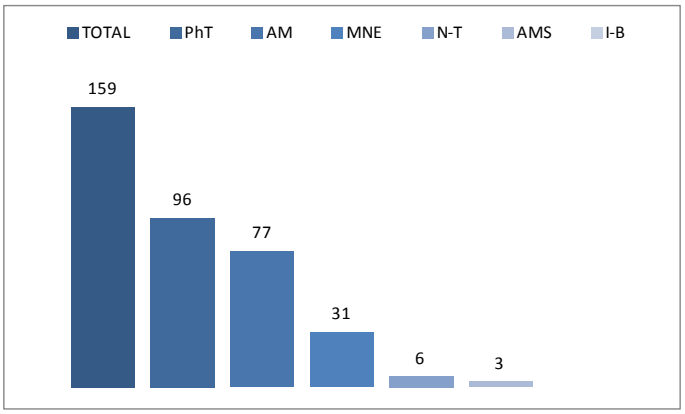
- (Sources: Glass Market Intelligence Report, Ispy publishing Industry Survey, Market Intelligence and Forecasts Series, 2013; www.schott.com).

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

- 159 exclusively KETs-related patents identified in the period 2001-2011 for the specific Innovation Field
- Overall, slowly increasing 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	77
AM / MNE	6
AM / MNE / N-T	1
AM / MNE / N-T / PhT	1
AM / MNE / PhT	3

AM / N-T	5
AM / N-T / PhT	3
AM / PhT	23
AMS	3
AMS / AM	2
AMS / AM / MNE	1
AMS / AM / MNE / N-T	1
AMS / AM / MNE / N-T / PhT	1
AMS / AM / MNE / PhT	1
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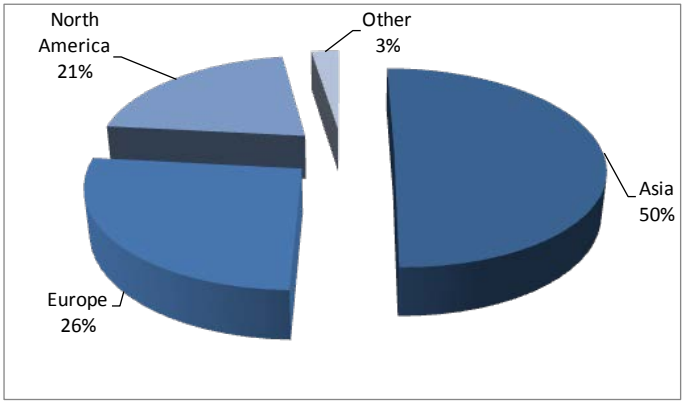
AMS / MNE / N-T / PhT	1
AMS / MNE / PhT	1
AMS / N-T	1
AMS / N-T / PhT	1
AMS / PhT	2
MNE	31
MNE / N-T	1
MNE / N-T / PhT	1
MNE / PhT	20
N-T	6
N-T / PhT	3
PhT	96

- Patent distribution by (Applicant) organization geographical zone:



- Patent distribution by geographical zone of priority protection: