## Future Project

# "Fibres & Paper 2030" – The Journey Continues

By Anatoli Davydov and Dr. Frank Miletzky

The findings from the CEPI Roadmap 2050 and Two-Team Project served as basis for the national "Fibres & Paper 2030" future project: Over a period of 15 months, a core project team, including representatives from the whole paper industry, looked even further ahead into the future of paper and its value chain to identify future requirements and new application areas.

Looking back to the year 2030, a total of 103 participants from a variety of sectors and subject areas initially developed 640 business ideas according to the motto "Doing what's thinkable instead of thinking what's doable" in six idea workshops (http://www.fibre-paper-2030.com/). The project showed that fibre-based materials will form an integral part of everyday life – even in areas where it is not or rarely used today: vehicle construction, healthcare, architecture or the aerospace industry, to name but a few.

The project has been completed, but the journey will be continued – you are cordially invited to join us! The lecture will inform about new projects in different thematic areas worked out in the future project. Novel fibre-based thermo-formable packaging materials for the production of compostable trays (ACTIPOLY) and packaging materials with selective gas permeability for oxygen and carbon dioxide (SELCTPERM) are innovative solutions in the thematic area logistics. Possible applications in the architectural sector are non-flammable corrugated boards with intumescent, flame-retardant and heat protective layers and specialty papers for electromagnetic shielding.

The review and follow up communication concepts and the strategies in realising the innovative fibre-based ideas will be also presented.

### Introduction

"Fibres & Paper 2030" was a national project aimed at identifying future needs and new industrial application areas for paper. Over a period of 15 months, a core project team of representatives from Associations of The Sectors and several companies looked ahead in the future of paper and its value chain. The main challenge was to describe future markets and business opportunities for the year 2030 in such a way that it is possible to derive practically applicable knowledge for course-setting strategic decisions and new, attractive business options.

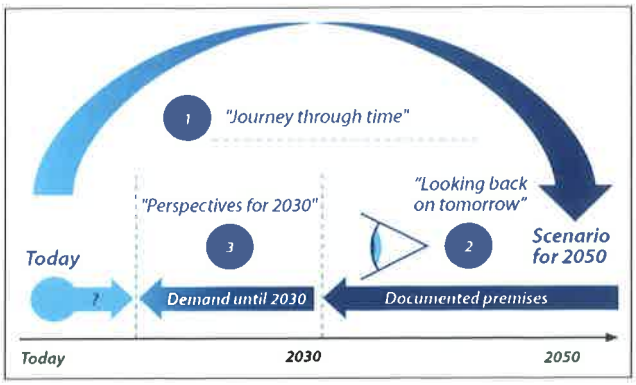


**Fig. 1: Method of "retropolation": by travelling through time to the day after tomorrow, we can "look back" on tomorrow**

Source: FENWIS GmbH

"Travel guide" Thomas Strobel from the company FENWIS GmbH and Anatoli Davydov, project manager at PTS, took the core team on a journey through time: They used the method of "retropolation" **(Fig. 1)** and simulated a trip into the year 2050 to look back to the year 2030. Eight topics were identified as being most relevant to the sector's future: nutrition, health & hygiene, mobility, information/communication/education/knowledge (ICEK), logistics, future cities & architecture, living & working, and general conditions.

In six brainstorming workshops, around 100 project participants from various fields and sectors developed almost 1,500 concrete ideas for new business opportunities. After consolidating and evaluating them, 640 ideas were left. 375 of them were considered to be directly related to paper because they could be realised with the know-how currently available in the paper chain. 265 ideas were indirectly related to paper, which means they are recognizable as attractive future demands but require further research to clarify how future paper materials can contribute to meeting these demands. The project results are available in a detailed brochure and on the website www.fibre-paper-2030.com to broadly communicate them.

### The journey continues

The future project has shown that paper is a sustainably made material which will find its prominent place also in tomorrow's world. Papiertechnische Stiftung is working actively to develop "papers for the future". The institute's research activities in this area focus on logistics and architecture.

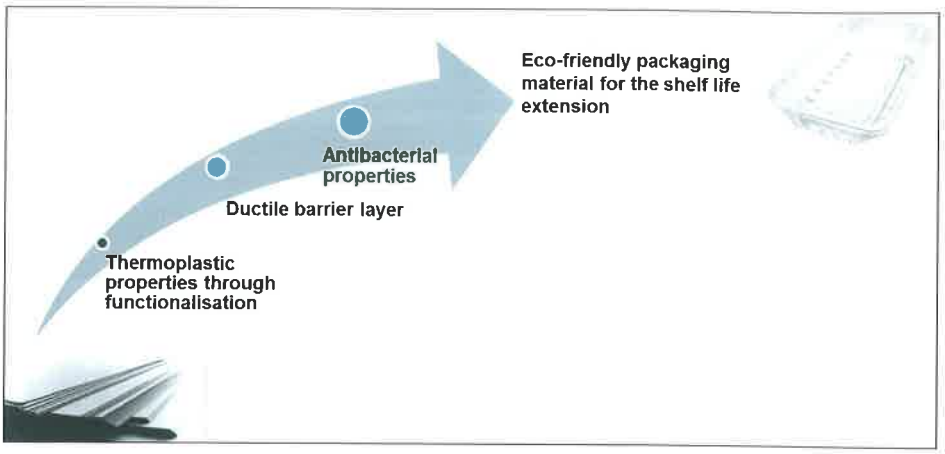


**Fig. 2: Development steps of packaging trays for meat and other food**

## Thematic area "Logistics"

"Smart packaging" will be a key element of future logistics systems. Multi-sensory packages with printed RFID technology will make it possible to trace every item on its way through the logistics chain, and packages with cooling or reminder functions, filling level or freshness indicators will contribute to greater food safety and optimise the use of materials and goods.

The results of the "Fibres & Paper 2030" project predict that ordinary food packaging will also be made by deep-drawing in future. The technique makes it possible to obtain a broad variety of shapes with small material and energy inputs because it requires no surplus materials. This vision is about to become reality: Since 2015, PTS scientists have been working in the ERA-NET CORNET project ACTIPOLY to develop fibre-based materials with barrier function and antimicrobial finish that can be deep-drawn for the packaging of fresh foods.

The project's main innovative idea is to modify fibre-based materials to make them thermoplastic and suitable for deep-drawing, e.g. for manufacturing trays. This will open up completely new potential applications for paper and other fibre-based materials. Further development work focuses on deep-drawable coatings that act as barriers against oxygen and water vapour or have antimicrobial effects to preserve the freshness and edibility and extend the shelf life of food. The overall packaging solution will of course be recyclable and compostable **(Fig. 2)**.

The steadily growing popular demand for convenience food like freshly cut fruit and vegetables requires more efficient packaging solutions. Existing ones like perforated films are not capable of creating an optimal atmosphere inside the package and limit the shelf life of packed goods, whilst closed conventional packages with high barrier effects against oxygen and carbon dioxide are not optimal because they facilitate anaerobic microbial growth.

Against this background, PTS scientists are currently working in the CORNET project "SELECTPERM" to develop a cost-effective, environment-friendly packaging solution that is selectively permeable to oxygen and carbon dioxide and whose permeation properties are adjustable to the specific requirements of respiring goods **(Fig. 3)**.
Ideally, the package will make it possible to optimally regulate the gaseous atmosphere in its interior for the packed food to enhance its shelf life and quality.

## Thematic area "Future Cities & Architecture"

Logistics is not the only sector that makes high demands on "paper for the future": Architecture, for example, offers many opportunities and challenges as well.

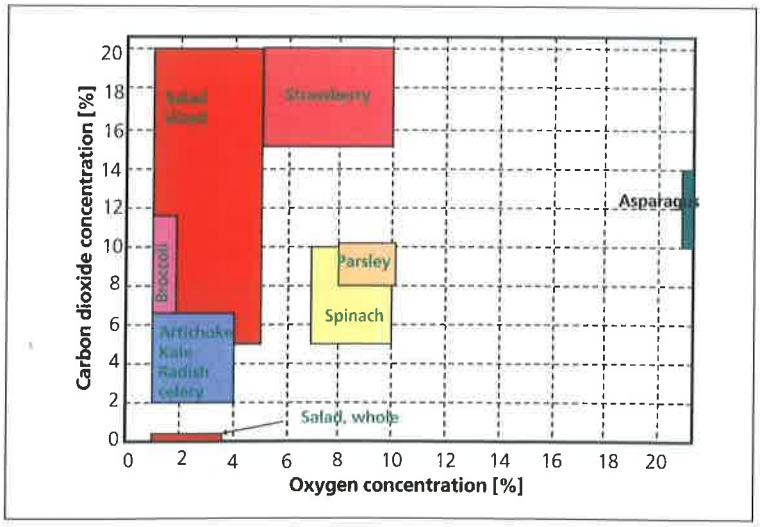


**Fig. 3: Atmospheric conditions required by individual foods**

Source: Fraunhofer IVV

A future-oriented research project in this area was the development of a special coating system for paper substrates capable of attenuating high-frequency electromagnetic radiation. The aim was to ensure the compliance with the limit values of the 26th Federal Immission Control Ordinance (BImSchV). A survey conducted by the European Commission revealed a considerable market demand for this: 46 % of the respondents had voiced concern about possible health risks of electromagnetic radiation.

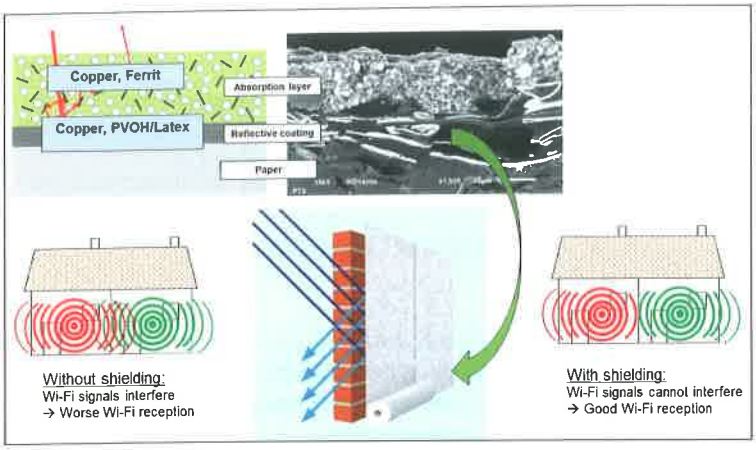


**Fig. 4: Structure of the new specialty paper and its use in domestic architecture** Source: www.everyday-feng-shui.de/feng-shui-news/wp-content/uploads/2009/12/elektrosmog-tapete.jpg and PTS

A coating of reflective, flaky, silvered copper pigments was found to have an attenuation effect of up to -55 dB. With around 3 €/m², the new specialty product can be manufactured at a cost level that is highly competitive and way below that of commercial shielding materials (> 20 €/m²).

One of its many promising applications is coated nonwovens: they can be installed in multiple dwellings to prevent interferences by neighbouring WiFi networks for better reception **(Fig. 4)**.

Another important function besides electromagnetic shielding is fire protection, especially the finishing of structural surfaces with flame retardants and fire barriers to avoid fires and limit their damage to persons and property. Fires continue to cause serious economic losses (around 25 billion €/a) in Europe, which leads also to high secondary costs for insurance premiums and the like. To limit these losses, better solutions are urgently needed in practice. Functionalising paper surfaces with so-called intumescent fire barriers is an innovative approach to manufacturing fireproof papers.

Broadly speaking, the barrier effect against fire and heat is produced by intumescent substances or coatings that swell and expand above a critical exposure temperature. They form a voluminous carbonaceous foam layer (char) which protects the underlying material against oxygen contact and direct flame impingement. Moreover, the foam is an excellent heat insulator preventing the undesired warm-up, thermal degradation or even melting of underlying materials. The basic mechanism is illustrated in **Fig. 5**.

The research project has led to coating colour formulations with polymer-coated sheet silicates that can be applied on paperboard surfaces to form mother-of-pearl-like structures. A mixture of nanoclay, kaolin and styrene-butadiene binder was found to be most suitable for this purpose. Besides good fire protection (class B2), the innovatively coated corrugated board materials offer good printability and converting properties **(Fig. 6)**.

Conceivable applications of the new coated materials are fire walls between building parts or flats, ceiling liners, partition walls and facade elements, among other.

## Summary and outlook

Besides generating fresh ideas for the paper sector, the future project "Fibres & Paper 2030" has shown that paper, being a bio-based material made from renewable resources, will form an indispensible part of everyday life also in future. Several innovative solutions are already available: Paper as innovative material for architecture or selectively permeable packages for logistics are no longer a vision, they have become a reality!

To make our sector's material fit for the future, we must strengthen the exchange in interdisciplinary networks to collect relevant information on future requirement profiles and include developers, designers and engineers right from the start in the design of innovative solutions based on "papers for the future". ■

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**Fig. 5: Self-assembling mechanism of a fire-resistant mother-of-pearl armour**
Source: Walther et al., Angew. Chem. Int. Ed., 2010, 49, 6448

**Fig. 6: Sample of a fire-resistant corrugated board material**