

VERSATILE – SAFE – SUSTAINABLE

**IMAGINE HOW HARD LIFE
WOULD BE WITHOUT SOFT PVC?**

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VERSATILE, SAFE, AND SUSTAINABLE

THE FUTURE NEEDS MODERN SOFT PVC

Extravagant designer bags, easy-to-care flooring in wood and stone finish, mirror-like stretch ceilings, as well as high-quality artificial leather for automobiles and furniture upholstery or PVC-covered fabric for futuristic-looking roof membranes: Modern products made of soft PVC combine outstanding properties with high aesthetic and tactile demands. At the same time, they are durable and economical.

Versatile Range of Products

The use of soft PVC in architecture, art, design, medical products, and automotive manufacturing is distinguished by its unique diversity. On the one hand, we owe this exceptionally wide range of applications to creative developers and workers in companies who customise products especially for the needs of our present-day society. On the other hand, the flexible material is endowed with numerous usage properties due to various formulas: e.g. high tensile strength for very thin food packaging films, the flame-retardance of cables and wires, and the sterilisation of blood bags.

Sustainable Properties

In the last ten years, soft-PVC products have changed considerably so that they now must be re-evaluated based on current standards. The reason for these changes is innovation by companies due to extensive research and decades of experience of working with their materials. The same holds true for progress in sustainable development in the PVC sector which involves the overall life cycle of these products. This has now been achieved throughout Europe by means of the sustainability programme VinylPlus. The enormous reduction in the use of energy in manufacturing and processing, the economical use of valuable resources, the application of ideal formulas with safe additives, as well as the successfully practised recycling of used prod-



ucts made of soft PVC are only a few examples. In the process, companies throughout the entire PVC supply chain are actively involved beyond the requirements for legal standards.

Safe Application

Flexible PVC products have been extensively tested for years in terms of their effect on humans and the environment. Information thus gained has been integrated into the development of soft PVC products with high quality and safety standards. We will introduce you to some of these applications below. And we will keep you posted on progress in the PVC industry on the path to sustainable development and scientifically sound findings about the safety of today's soft PVC products in terms of health.

Thomas Hülsmann
Managing Director of AGPU Media GmbH

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DIVERSITY ON PRINCIPLE: THE FLEXIBLE MULTI-TALENT IS AT HOME EVERYWHERE

Soft PVC can be processed in various ways. PVC products offer high quality with demanding technical and aesthetic standards. By innovatively changing the formula, products can be altered precisely to the respective list of demands. In so doing, an incredible range of material properties results. New applications continuously expand the choice of products and show the modernity of the plastic material which has been in use for over 50 years.

The largest product group in soft PVC applications consists of cables and wires with a flame-retardant insulation or coating made of soft PVC. Used for energy supply, control functions and communication, these products have special material properties. Cable harnesses in automobiles control complex processes within the smallest spaces, withstand high physical stress, and must be especially light weight. Special cables made of soft PVC for chemical plants and petrol stations offer outstanding resistance to petrol and oil.



This concept car by the company Rinspeed relies on PVC artificial leather for many areas of interior design in automobiles. The inside of the doors, the seats, and the dashboard are upholstered with the soft high-quality material.

Photo: Konrad Hornschuch AG



The multi-functional stadium in the Turkish megacity Konya: PVC-coated membranes in white and green shape the roof of the new arena with a surface area of 76,000 square metres.

Photo: MEHGIES

The World of Film

Soft PVC film is available in various colours and grades of thickness with entirely different material properties and surface structures. It affords various benefits, facilitates our daily lives,

and is harmless to human health. In food packaging, extremely thin stretch and shrink film with oxygen barriers ensures long shelf life for meat, fruit, and vegetables. Self-adhesive decorative film for refining the surface of furniture, doors, and glass adds a personal touch with floral patterns or fashionable wrinkle effects. In addition, eminently printable films exist for designing vehicles, for advertising purposes, or for marking escape routes. Resistant film coverings for window profiles open up enormous creative possibilities for architects and building owners in terms of design, texture, and colour. Meanwhile, there is special film which does not heat up too much and therefore contributes to a positive indoor climate.

Construction and Interior Design

Vinyl wall coverings with elegant decors and elaborate structures, extremely thin wall tattoos, as well as floor coverings in fine wood and natural stone finishes are important elements of interior design. Cushioned upholstery for the furniture and automotive industries made of light-resistant, heat-stabilised artificial leather with a soft PVC coating offers extreme seating comfort and a natural feel in exclusive premium-class interior spaces as well as on sailing yachts and sports boats. The impressive roof constructions of the football stadiums in Hamburg, Cape Town, London, and Rio de Janeiro, or for the German Expo pavilion in Milan are an expression of the modernity of the material used for textile architecture. PVC-coated membranes made



Self-adhesive and transparent coloured film, which the French artist Daniel Buren used here for his project to refurbish the Festspielhaus in Recklinghausen, provides artists and architects with enormous possibilities of design.

Photo: © Ferdinand Ullrich, Kunsthalle Recklinghausen

of extremely tear-resistant fabric provide dependable protection from the weather and leave nothing to be desired in terms of appearance.

Medicine

In the field of healthcare with high safety standards, PVC products have successfully stood the test of time for decades. Sterilisable blood bags with good biocompatibility protect blood and extend storage life. Pliable tube systems for infusions and transfusions provide patients with a precise supply of fluids and blood. Disposable products such as gloves protect against chemicals, viruses, and bacteria. Easy-to-clean flooring promotes hygiene and a dust-free environment in hospitals. Equipped with an anti-static surface, these coverings are often used in extremely sensitive areas such as clean rooms in the pharmaceutical industry or in electronics manufacturing. Soft PVC is also recommended for its low allergy potential and is especially well suited for special wound dressings and elastic bandages.



Fashion and Leisure

Many products made of flexible PVC are setting trends in the world of fashion: from ultramodern handbags made of artificial leather and used lorry tarpaulins to casual summer sandals and rain boots. In recreation, tested water wings and sturdy inflatable pools provide safe fun to children since the material is reliably airtight. Inflatable boats and life rafts are also made of resistant PVC-coated textile fabric.

Future Dreams

The Fraunhofer Institute for Chemical Technology in Pfinztal determined in its study "Technologiestudie zur Verarbeitung von PVC" (Fraunhofer ICT, 2005) that virtually no other thermoplastic material exhibits such extensive material properties, processing methods and post-processing methods as PVC. And development goes on. New insights are now emerging by processing or coating PVC carrier film. In the future, packaging films might be able to provide information about the condition of the food such as freshness and temperature. Inflatable pneumatic supporting structures made of coated-PVC polyester fabric are able to carry their own weight many times over and are being tested for the use in building bridges. Mobile noise barriers made of inflatable PVC-coated membranes are just as effective in reducing noise as massive concrete products despite their weight. The possible applications of soft PVC are far from exhausted.

Vinyl wall coverings with elegant prints, elaborate textures, and striking relief designs impressively set the scene for these walls. Since they are water- and abrasion-resistant, they offer a permanent design solution for frequently-used rooms.

Photo: Deutsches Tapeteninstitut

THE PVC SUPPLY CHAIN

INNOVATIVE IN EVERY PHASE

The supply chain of the PVC industry is comprised of completely diverse companies. In addition to the manufacturers of raw materials and additives, these include producers of PVC products and recycling partners. In their respective fields, they have all brought about considerable innovation and, in the process, they have made a great contribution to resource efficiency and the sustainability of the material.

In Germany, approximately 60 companies throughout the entire PVC supply chain in the AGPU are actively working with the forward-looking material. In the process, they make use of their national and international industry networks, pool their knowledge, and cultivate an open dialogue with decision-makers from the economy, politics, the media, and non-governmental organisations (NGOs). A key instrument in promoting the sustainable development of PVC is VinylPlus, the Voluntary Commitment of the European PVC industry. In the process, resource efficiency and the reduction of CO₂ throughout the entire life cycle are also decisive instruments which are necessary to implement a successful energy transition.

Progress in all Areas

Innovation exists in all areas of the PVC supply chain, beginning with the manufacturing of raw materials and products to recycling. For example, the industry has taken a new direction in manufacturing chlorine. Today this primarily occurs through the membrane process, which together with the diaphragm process will have replaced amalgam technology in the EU by the end of 2017. Already today electricity consumption has dropped by approximately one quarter as a result of the change in technology. Furthermore, additives such as stabilisers and plasticisers are being continuously developed.

Processing and Use

Resource efficiency is also an important topic in the processing phase of the material. For example, up to 30 percent of energy can be saved in the extrusion of plastic window profiles through ideal production plants and cross-sectional technology. Such clear savings are also achievable in manufacturing films and floor coverings. In so doing, the processing procedures for PVC products have become increasingly more refined. In the utilisation phase, modern PVC applications save valuable resources through durability, easy care, and long life cycles.

Recycling

The European PVC industry has also taken steps to save resources beyond the manufacturing processes. The recovery of the most important PVC products has been organised by establishing functional collecting and recycling systems. Recycling processes have been continuously developed. No matter whether it involves rigid PVC in window profiles and pipes or soft PVC in flooring, cable insulation, or even composite materials such as PVC-coated fabric: modern recycling processes save valuable resources and continuously return larger amounts of recyclates to the materials cycle. Today it is understood that a share of the recycled materials should be used to manufacture modern PVC products without worries about limitations in terms of quality, functionality, and safety. By 2020, the European sustainability programme, VinylPlus, wants to achieve a registered annual recycling amount of 800,000 tonnes and it is well on its way to doing this. The contribution of the German PVC industry to the current amounts is already more than one third.



This modern control station monitors all processes in manufacturing chlorine through the membrane procedure.



Markus Dünkelmann, Managing Director, PROJECT FLOORS GmbH

"Design floor coverings made of PVC have been the winner for years in the flooring industry and have increased their turnover by nearly sevenfold alone in Germany in the past ten years. This success can be traced back to the perfect combination of functional qualities and authentic finishes which have made these floor coverings appealing for commercial use and more and more for private use. The manufacturers organised in the FEB (Association of Elastic Flooring Manufacturers e.V.) work constantly on improving products and making innovative progress in terms of manufacturing processes, decor presentations, surface looks, installation techniques, and, naturally, environmental and health features. The well-known providers stand behind this entirely through certified production locations and confirmed harmlessness."



Mailin Bode, Corporate Sustainability and Innovation Manager, RENOLIT SE

"The search for future perspectives and new approaches takes place at all levels of the supply chain. The PVC industry is in constant development, and we as a film specialist aspire to be pioneer in the market. For this reason, innovative work for us takes place in two areas at the same time: in the individual business units, and centrally at the company level. In this way, we develop practical innovations for the future and make sure that our products always improve. Soft PVC plays an important role in this process. Due to its versatility, it constantly offers opportunities for completely new solutions in various application areas. For this reason, our high-performance films, for example, can be found in unique art projects and visionary installations in architecture."



Joachim Tremmel, Chairman European Council of Plasticisers and Intermediates (ECPI)

"The industry is confronted with continuously growing pressure in terms of regulatory challenges and technical requirements. A safe and sustainable use of its products must be enabled throughout the supply chain. Since plasticisers are produced in large amounts, they have undergone extensive testing for possible health and environmental effects and are amongst the most widely examined chemical substances overall. They provide PVC with flexibility and elasticity which is necessary in many applications, e.g. in the construction industry, in the automotive industry, in medicine, or for furniture and artificial leather goods. Plasticisers are important functional substances altering the physical properties of PVC and other polymers. They enable a whole new world of flexible and robust applications."



No matter whether they are for stores or children's bedrooms: PVC flooring satisfies the highest technical standards and offers enormous comfort and safety due to optimal formulas.

SUSTAINABLE DEVELOPMENT

FROM MANUFACTURING TO RECYCLING



Extremely thin wall stickers made of PVC film turn designing walls into child's play. Afterwards, the film can be removed without residue.

Photo: Konrad Hornschuch AG

As a result of enormous ecological, economic, and social progress throughout the entire PVC supply chain, products made of soft PVC have changed significantly in recent years. The German PVC industry established the basis for this at the beginning of the 1990s through intensive dialogue on the sustainable development of PVC products. It brought together all important target audiences from science, politics, industry, NGOs, and the media.

One result of this long-term process was the Prognos Study on the topic "PVC and Sustainability" published in 1999. For more than 15 years, the European PVC industry has joined together and made great effort to master challenges concerning sustainable development. In 2000, the four main European Associations, ECVN (PVC manufacturers), ECPI (PVC plasticiser manufacturers), ESPA (PVC stabiliser manufacturers) and EuPC (plastics converters) signed Vinyl 2010, the Voluntary Commitment of the PVC industry for sustainable development, with specific objectives

Roof gardens offer enormous ecological benefits and improve the energy balance of buildings. Root-resistant sealing membranes made of PVC provide a weatherproof foundation.

Photo: RENOLIT SE

for the use of sustainable additives as well as the development of recycling technologies and amounts. All the objectives of Vinyl 2010 were achieved, and some even surpassed. At the same time, the conclusion of Vinyl 2010 marked the beginning of the new sustainability programme, VinylPlus, which was launched in the summer of 2011 and was built on the success of the previous programme. VinylPlus brought together leading companies from the PVC industry from 28 EU member states, plus Norway and Switzerland. The agreement on objectives which is valid until 2020 was conceived together with the renowned Swedish sustainability institute "The Natural Step". Progress against the objectives is reviewed on an annual basis.

Manufacturing and Raw Materials

European PVC manufacturers passed an industry charter under the auspices of the ECVN in 1995. In this document, the signatories committed themselves to continuously reducing environmental pollution as defined by Responsible Care. Specific emissions limits were set in 1999 which established unified European standards for the first time and were designated as ambitious by the German Federal Environment Agency (UBA). Companies have reduced the emission of chlorine and vinyl chloride in the air and water by more than 90 percent over the past 25 years, according to the results of the study "The Current Situation of Soft PVC in the Relevant Content Areas" (2007) by the Austrian Institute of Industrial Ecology. >>



As a result, the concentration of vinyl chloride is considerably lower today than prescribed by the guidelines for the protection of workplaces. In general, all manufacturing processes from pre-production to PVC were optimised, as well as the processing procedures for the conversion of high-quality raw materials to finished products. Furthermore, PVC raw material manufacturers have made considerable progress in work safety by introducing closed plants in the 1990s, a high degree of automation, and extensive safety equipment. Companies' enormous sense of responsibility for their employees is reflected in the large number of certified plants in the EU.

Economical and Durable

PVC is made of 57 percent from virtually unlimited salt reserves and only 43 percent from crude oil. The low percentage of oil saves valuable, non-renewable resources. Since the material can be processed at low temperatures in comparison to other materials such as metal, glass and ceramics, energy consumption for manufacturing PVC is relatively low. All in all, products made of soft PVC are very economical due to their inexpensive purchase price and low maintenance costs for their entire life cycle. For example, this is true for PVC floor covering which has pleasingly-low operational costs. The exceptionally pore-free, smooth surfaces are resilient, dirt resistant, and extremely easy to clean so that maintenance costs are reduced by up to 30 percent in comparison to other materials: this is a large amount since maintenance costs make up approximately 90 percent of the overall costs for the 10-year use of floor coverings. Outdoors and below ground, cables coated or insulated with soft PVC last about 40 years and seldom have to be replaced. Water and abrasion resistant vinyl wallpaper in trendy decors is robust and



An enormous advantage of exterior film made of soft PVC is the homogeneity of the surface, no matter on which building elements the film is applied. In this way, the windows fit perfectly to the house and garage doors, and the house exterior makes a uniform impression.

Photo: Konrad Hornschuch AG

durable. Root-resistant sealing membranes provide a weather-proof foundation for roof gardens and improve the energy efficiency of buildings. Moreover, many products made of soft PVC are lighter than alternative materials. Therefore, less energy is needed to transport the materials and their processing is facilitated considerably.



Children enjoy playing on floors. PVC floor coverings are ideal because they are soft and warm.

Photo: WALA-Walter Landers GmbH

Easy Processing

The often simple processing of soft-PVC products minimises work and therefore saves money. Sealing membranes made of soft PVC for lining swimming pools can be easily installed without folds in unusually shaped basins and canals. Along with its favourable purchase price, easy maintenance, and long life cycle, PVC offers a very good price-performance ratio. Saltwater-proof, UV-resistant wrapping film made of soft PVC for the hulls and superstructures of ships permanently protects boats from weather conditions. In comparison to painting, it can be applied without protective equipment and time-consuming preparation work. Easily installable vinyl stretch ceilings can be assembled in just one day, never require a coat of paint, and offer an easy-to-clean and attractive alternative to expensively renovated ceilings.

This modern living room is provided with a light and friendly atmosphere through a light stretch ceiling made of soft PVC film. In contrast to other design possibilities, this ceiling solution does not require any paint and is quickly installed.

Photo: RENOLIT SE



Enormous Benefits for Society

Many products made of soft PVC are characterised by their enormous benefits for society. Welding curtains and reflective clothing improve work safety. Medical products such as blood bags and tube systems are indispensable for patient care and irreplaceable during patient recovery. Soft comfortable seating cushions with attractive artificial upholstery improve the quality of our lives.

Organised Recycling Throughout Europe

In recent years, the European PVC industry has developed a responsible waste management program with tremendous effort and organised the recycling of important PVC building products through well-functioning collection and recycling systems. Since the costs of raw materials and energy are constantly rising, market conditions for PVC recycling will most likely prosper. Thus, valuable resources are saved and the sustainable properties of PVC products continue to improve.

Good Evaluations

Various PVC products such as window profiles, pipes, cables, floor coverings, membranes, and film have been examined in several European countries in terms of their life cycle assessment and ecological efficiency. In these examinations which comprise the entire life cycle of products including their impact on the environment from manufacturing to disposal, PVC has put forth a convincing environmental performance. The EU Commission commissioned a study of over 230 life cycle assessments published in 2004 which also shows the sustainable properties of PVC products. According to the study, PVC is classified as ecologically equal to alternative materials.

An example of the ecological efficiency of soft-PVC products is the evaluation within "eco-devis" (a planning tool for the tender of construction work which incorporates an ecological assessment) by eco-bau in Zurich. Eco-bau is an independent organisation supported by public and private institutions which fosters ecological construction in terms of sustainability. Vinyl flooring made using the new types of raw materials (plasticisers, stabilisers) and which can be recycled at the end of life now gains a positive classification within "eco-devis". Thanks to such positive



Made of PVC insulation from used electrical cables, this practical traffic separator always keeps automobiles and bicycles on the right track.

Photo: Zicla

evaluations, in recent years modern PVC flooring has been able to greatly improve its acceptance in private and especially in public construction.

For more and more building products such as floor coverings, roofing and sealing membranes, as well as windows and pipes, Environmental Product Declarations (EPDs) are now available which are based on internationally valid ISO norms. They document characteristics of these building materials such as environmental compatibility, resource and energy consumption, and longevity and maintenance. The manufacturers offer relevant information on each certificate according to each country.

Well-Founded Re-Evaluation

The PVC industry has proven its credibility as a reliable industrial partner and has succeeded in obtaining a re-evaluation of PVC based on progress in sustainable development. It is for good reason that many German federal states, municipalities and cities, which in the past went without PVC products in publicly-funded building projects, have now found their way back to using the material. This is proof that the enormous efforts by the PVC industry to promote sustainable development have been noticed and recognised by target groups. "By repeatedly showing the performance of PVC and comparing it to other materials, it has been possible to reverse public opinion and to make the material socially acceptable again," stated Professor Dr. M. Dröscher, President of the German Chemical Society, at the beginning of 2010 in "CHEManager".

Bags made from used truck tarpaulins are not only modern. They also save valuable resources by ideally making use of the durability of the material.

Photo: AGPU Media GmbH



These rain boots made of soft PVC remain reliably waterproof. Even standing in the pouring rain is the greatest pleasure.

YOU CAN REST ASSURED: PRODUCTS MADE OF SOFT PVC ARE SAFE AND RELIABLE

Like all products, applications for soft PVC must be safe for humans and the environment during manufacturing, processing, and subsequent use. The PVC industry accepts this responsibility with the help of modern production methods, the use of valuable raw materials, and the conscientious implementation of resources. It is self-evident that regular examinations of products are carried out by companies in terms of quality, safety, and environmental compatibility and by independent testing institutions with respect to valid guidelines and norms.

In Germany, numerous committees and political institutions dealt with the topic of PVC early on. This included the Enquête Commission "Protection of Humans and the Environment" which carried out the most extensive examination and evaluation of PVC along with all parties represented in the German Federal Parliament and various groups in society. The final report, presented in 1994, came to the conclusion that PVC is by far the most widely-examined material in terms of its relevance for the environment. The replacement of PVC by alternative materials,



Soft-PVC products offer good protection when it really counts: this robust, inflatable swimming vest remains reliably airtight in water. Photo: ECVM

about which comparatively little was known in terms of their environmental impact, was not recommended due to lack of economic and ecological information and could have led to a deterioration of the situation at that time.

High Standards for Quality and Safety

In general, high safety and quality standards are important for placing products on the market. For this reason, EC guidelines on the safety of products in the European Economic Area (EEA)

Cushioned upholstery in calfskin texture with an especially easy-to-clean surface is flame retardant, disinfectant resistant, and therefore ideally suited for use in hospitals and nursing homes.

Photo: Konrad Hornschuch AG

establish the valid requirements for products such as construction materials, medical devices, and toys. Companies throughout the PVC supply chain comply with all national and European legal requirements and guidelines in manufacturing raw materials and processing them into finished products.

Success of the PVC Industry

In recent years, the PVC industry has achieved great success in labour, health, and environmental protection. For example, progress has been made in terms of formulas which have an effect on the properties of finished products and open up a multitude of applications for this material. The use of stabilisers provides sufficient heat-stability for PVC during processing and protects the finished product from change through warmth, UV-light, and oxygen. In the past few years, the use of certain additives (cadmium and lead stabilisers) has been discontinued as part of the continuous improvement in the safe use of PVC products in all EU member states. Lead stabilisers have been fully replaced since 2016.

PVC is highly flame retardant and is self-extinguishing in case of fire. Since the use of this material considerably reduces the risk of starting and spreading fires, PVC can be implemented as a preventive measure for fire protection.

Intensively Researched

For many years, products made of soft PVC have become a mainstay in sensitive areas such as medicine and children's toys. The soft-PVC market has considerably changed in recent years through long-term research and improved formulas. As a result, European PVC converters increasingly use plasticisers with a higher molecular weight instead of low-weight plasticisers. For example, these include DINP, DIDP and DPHP. >>





Modern automotive wires are not only convincing due to their outstanding technical qualities. New developments with ultra-thin insulation made of soft PVC require considerably less space and reduce the weight of the vehicle at the same time.

Photo: Leoni AG

Along with other special plasticisers, the percentage of their use in Europe is at 85 percent and is rising continuously due to an increase in technical and environmental requirements for soft PVC products.

During processing, plasticisers are stored between the polymer molecular chains and physically bond with PVC. In this way plasticisers provide PVC products with special properties such as flexibility, elasticity, and stability of shape and at the same time have an influence on the processing properties. They offer clear advantages and can be handled safely and implemented in all applications during their time of use.

The PVC industry is continuously working on the development of new substances to supplement existing products with equally reliable products. New types of plasticisers for applications with special properties are on the market and are being successfully implemented.

Safety through REACH

REACH, the European Community regulation on chemicals and their safe use, shows the comprehensiveness of scientific facts for commonly used plasticisers. According to this regulation, chemical manufacturers must present information on their substances to prove safe manufacturing and use. The registration of DIDP, DINP and DPHP has successfully been completed. These plasticisers comply with REACH requirements and are not on the candidate list of substances which must be further examined. In 2014, the EU Commission again concluded in a renewed evaluation of DINP and DIDP that their use in all applications posed no risk and that further steps to reduce their exposure were not necessary. The existing limitations for toys and baby articles which can be placed in the mouth by children remain intact. In this respect, the EU Commission agrees with the results of the European Chemicals Agency (ECHA).



Coloured film is distinguished by its high opacity and colour consistency.

Photo: RENOLIT SE



Soft PVC products are able to fulfil increasingly high demands to an even greater extent. In April 2015, the French Agency for Food, Environmental and Occupational Health & Safety (ANSES) published a toxicological evaluation of the plasticisers 1,2-Cyclohexanedicarboxylic acid, diisononyl ester (DINCH) and Di-(2-ethylhexyl)terephthalate (DEHTP) in the context of a national strategy for endocrine active substances and REACH. In its analysis, ANSES came to the conclusion that no special risk-management steps were necessary under REACH for these two plasticisers.

Furthermore, special plasticisers are now used which in the meantime have gained in economic importance. For example, these include polymeric plasticisers based on adipic acid, adipate, citrate and others.

Especially high demands are made on products such as medical articles and toys.

Photo: AGPU Media GmbH

A modern bathroom with a wood-grain thermolaminate vanity, a toilet, and a glass shower enclosure. The vanity has a white countertop and a chrome faucet. The wall behind the vanity is covered in wood-grain thermolaminate. The toilet is white and has a white flush plate on the wall. The shower enclosure is made of glass and chrome. The floor is light-colored tile. A green mat is on the floor in front of the shower.

Sophisticated design, high quality, outstanding material properties: Thermolaminate on the basis of PVC is best suited for designing the surfaces of robust furniture fronts in kitchens, baths, and bedrooms.



This extremely weather-resistant "Barlooon" garden lantern made of high-quality soft PVC provided atmospheric lighting at the Bundesgartenschau 2015 in the Berlin region.

SOLID SALES FOR PVC PRODUCTS: ECONOMIC DATA AND FACTS

Whether hard or soft: PVC products are enjoying increasing popularity. The worldwide consumption of PVC reached more than 40 million tons in 2014. It is therefore the most widely-used plastic material after polyethylene and polypropylene and was in third place internationally.

Apart from the effects of the worldwide financial crisis which left no economic sector unscathed, the PVC industry can be satisfied with its continuous growth in recent years. This is especially true for the German market which has taken top position in Europe. In 2014, approximately 1.5 million tons of PVC polymer were processed in Germany. In Europe, growth increased at a comparatively slower rate: this can be traced back to the market penetration which had already been achieved. The fact that an increase was still recorded at this high level testifies to the major importance and modernity of PVC.

Strong Economic Sector

Many people earn their money in the PVC sector and profit from the comparatively high salaries in the plastics industry. In 2014, the European plastics industry generated an overall turnover of 350 billion Euros. More than 1.4 million employees work in approximately 62,000 companies – most of which are small and mid-sized companies (source: PlasticsEurope: Plastics – The Facts 2015). Thus, they are part of a strong economic sector which provides a livelihood to many people.

Hard or Soft

Approximately two-thirds of all PVC products in Europe are made from hard PVC. In particular, this includes energy-saving windows, pipes, and rigid film. The remaining one-third is made up of soft PVC. The most important applications are covered and insulated cables and wires, film, easy-to-clean flooring, roofing and water proofing membranes, as well as coated textiles.

Construction Sector as the Front-Runner

Most PVC products are meant for the construction sector with more than 70 percent of the market share. This mostly includes windows, pipes, floor coverings, roofing and water proofing membranes, as well as cables and wires: in all, these are applications with very good long-term qualities. It is therefore not surprising that long-life PVC applications dominate the market as detailed studies have shown about the life of PVC products in Western Europe.

Whether for energy supply, control functions, or communication: PVC-coated or insulated cables and wires are persuasive in low-voltage areas of up to 1,000 volts because of their outstanding technical properties.

Major uses of soft-PVC products



Profiles and tubes



Coatings



Others



Flooring and wall covering



Film

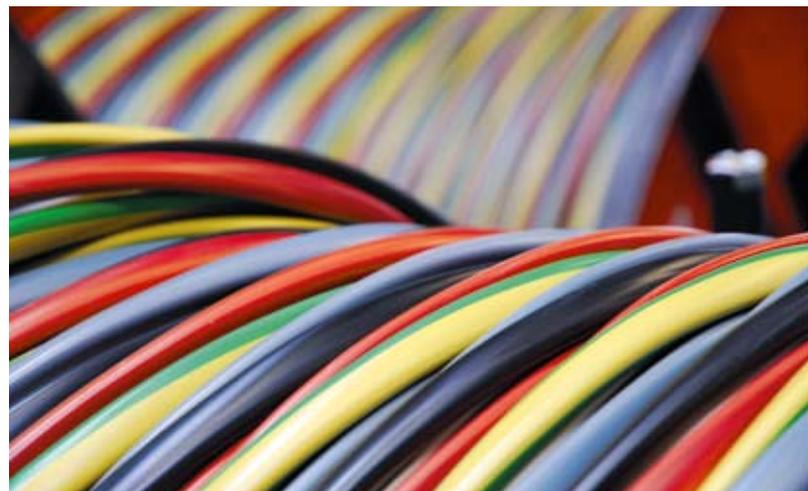


Wire and cable

Source: ECPI 2014

Economic Crisis Overcome

The economic crisis in 2008 / 2009 also had an impact on the West European PVC market. In the meantime, the market has recovered and is cautiously optimistic. A moderate revival of market demand for Western Europe has already begun. The question of how this development will continue in individual countries depends heavily on their respective construction industries. Ultimately, the major share of all PVC products is used in the construction sector.



THE HEART OF THE MATTER: IMPROVED PRODUCTS FOR A SAFE FUTURE

Whether safety, diversity, or sustainable development: products made of soft PVC satisfy high demands in many ways for modern and trend-setting solutions. A wide spectrum of flexible PVC products enhances our lives and makes them more comfortable and secure. The reason for this success is the decades-long experience of the PVC sector with this material. This know-how and years of research create the basis for continued improvements of flexible PVC products through high safety standards, improved formulas, and sustainable properties. These are qualities appreciated by consumers the world over.

- ✓ Due to its diverse material properties, soft PVC is the material of choice for an extremely wide range of products. For example, these products are found in the construction sector, interior design, in healthcare, at home, at work, and in art and design.
- ✓ Flexible PVC products are irreplaceable in our lives and indispensable for the future. They fulfil the need for elastic flexible products with diverse applications. Tested water wings help children with their first strokes in the water. Soft rain boots keep our feet warm and dry. In medical treatment, pliable tubes provide a well-dosed nutritional care for patients. These systems can be sterilised by all common methods and thereby contribute to more safety.



Swimming pools can be easily lined without folds using PVC sealing membranes. They are persuasive because of their life cycle of more than 20 years and their easy maintenance.

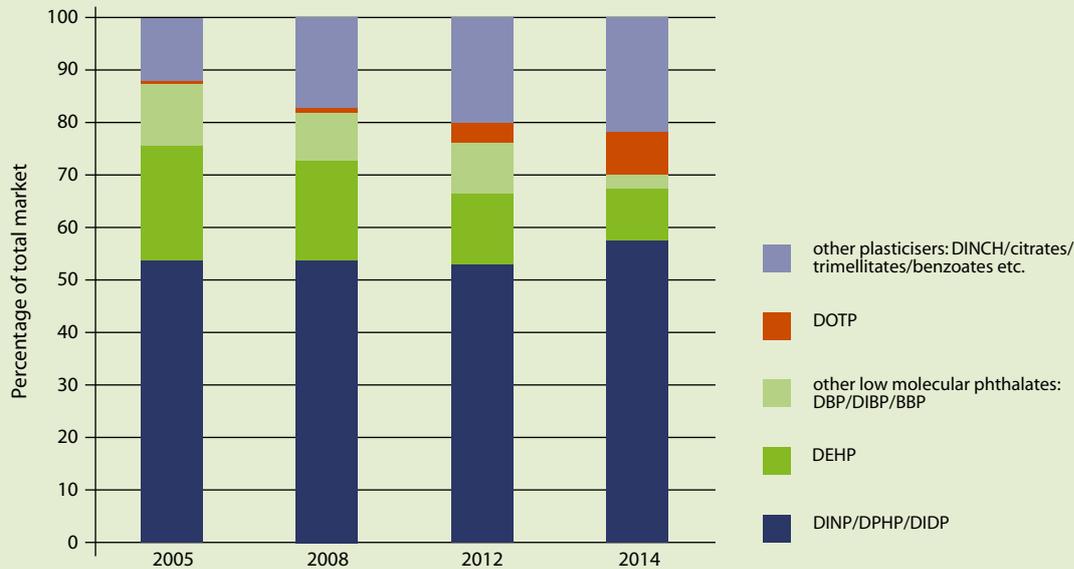
Photo: DLW Flooring GmbH



Many products made of soft PVC enhance our lives during leisure time. These include air mattresses made of very stable, flexible, and durable film which makes time on the water a special treat. Photo: AGPU Media GmbH / Ralph Richter

- ✓ Soft PVC products are valued across the globe. They are characterised by their longevity, cost-effectiveness, safety, and high quality. For example, floor coverings are especially easy to clean because of their smooth surfaces and therefore offer pleasingly-low operating costs. Or extremely flame-retardant cable insulation withstands humidity, heat, and cold for decades and remains flexible the entire time.
- ✓ The German PVC industry has promoted the sustainable development of its products since the 1990s. Moreover, European PVC raw material manufacturers, plasticiser and additive producers, and converters have contributed greatly to the sustainable development of their products through the Voluntary Commitment "Vinyl 2010" and since 2011 "VinylPlus" and they also will do so in the future.
- ✓ European PVC producers have consistently improved their manufacturing processes. The emission of chlorine and vinyl chloride into the air and water alone has been reduced by more than 90 percent in the past 25 years. These are the results of the study "The Current Situation of Soft PVC in the Relevant Content Areas" (2007) by the Austrian Institute of Industrial Ecology.
- ✓ Due to years of research and improved formulas, the market for soft PVC has fundamentally changed in recent years. The European PVC sector has reduced its use of low-molecular weight plasticisers in favour of standard high-molecular

Percentage of the different plasticisers in the EU28 plus East European countries



Source: ECPI

weight plasticisers such as DINP, DIDP and DPHP. The percentage of these plasticisers and other special plasticisers for applications with particular demands has risen to 85 percent in Europe in the meantime. Studies and official risk assessments by experts commissioned from all EU countries verify that these materials are safe and can be used without concern.



Solid basis for young talents: sports flooring made of PVC is extremely durable and minimises the risk of injury.

Photo: Gerflor Mipolam GmbH

- ✓ "Articles made from PVC do not present a risk to human health and the environment, provided that they contain the appropriate additives and are disposed of in accordance with the existing legal obligations," reported the EU Commission in November 2010, responding to an inquiry by the European Parliament.
- ✓ The use of heavy metals in stabilisers has decreased significantly. Cadmium stabilisers have not been sold in the EU since 2007. Lead stabilisers were completely replaced at the beginning of 2016.
- ✓ PVC saves resources. It is made of 57 percent salt, which is available on the planet in virtually unlimited amounts, and 43 percent crude oil.
- ✓ Approximately 90 percent of soft PVC is processed into durable products such as floor coverings or cable insulation and exceeds the longevity of alternative materials. This protects valuable resources, saves energy, and reduces costs.
- ✓ In life cycle assessments, PVC products provide a convincing environmental performance over their entire life cycles. The EU Commission commissioned a study of over 230 life cycle assessments and came to the conclusion in 2004 that PVC is classified as ecologically comparable to alternative materials.
- ✓ The recycling of important PVC building products such as windows, pipes, floor coverings, roofing membranes, and cables is now organised by the European PVC industry. With this clear commitment to the recycling economy and saving energy, companies are making an important contribution to sustainable development.