

How does the use of EMICODE®-certified parquet adhesives affect the sustainability of parquet floors?



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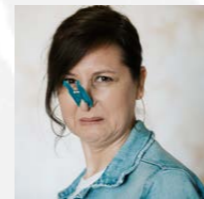
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■ Introduction

Over the past 50 years, the construction of buildings has undergone massive changes. In earlier days, the main task of buildings was to provide residents with “a roof over their heads” and to protect them from all weathers. These days, buildings are expected to fulfill many more tasks that have been added over time. In the 1980s and 1990s in particular, demands on the airtightness of buildings increased more and more in order to reduce the consumption of energy. As a result, “outgassing” – which means emissions from building materials into indoor air – became a key issue. Due to the installation of passive ventilation systems, the permanent and latent exchange of air was reduced. As a result, harmful emissions escape to the outside at a much slower rate.



In the 1990s, however, there was no benchmark that would have given architects, planners, craftsmen and consumers guidance in their search for low-emission primers, fillers and flooring adhesives – let alone security in the jungle of available products. The year 1997 saw the foundation of the GEV – Gemeinschaft Emissionskontrollierte Verlegewerkstoffe e. V. (Association for the Control of Emissions in Products for Flooring Installation), which launched the EMICODE® quality seal for building products. The EMICODE® seal was meant to create transparency, to prevent the inflationary use of non-comparable environmental claims (“green claims”) at an early stage, and to serve as a product selection guide. Since then, the EMICODE® has developed into a vendor-neutral, internationally established quality and eco label.

26 years after the GEV’s foundation, the topic of sustainability is now a key issue in almost all spheres of society and economy. More than 50 years after the Club of Rome published “The Limits to Growth”, also the general public is now becoming aware that the Earth’s resources are limited and the sustainable management of these resources is absolutely essential.

This raises the question of how “sustainable” EMICODE®-certified products are and which impact they have on the building components that are produced with them. At present, only one aspect of sustainability can, in fact, be considered here and that is **environmental sustainability**. Economic and social aspects are definitely relevant, but the associated data and facts are only partially known.



For more than 28 years now, parquet adhesives that have been awarded the EMICODE® EC 1 or EC 1^{PLUS} label have been able to meet many sustainability parameters. Moreover, they help increase the specific sustainability of the structural component ‘parquet floor’ by extending its service life.

■ Basic terms

CONSTRUCTION PRODUCTS:

EMICODE®-labelled building products are used on construction sites both inside and outside of buildings. As a rule, they are auxiliaries that help produce the building component desired by the architect or building owner.

Article 2 of the EU Construction Products Regulation (CPR) (German: EU-BauPVO)¹ defines construction products as follows:

“Under the terms of the CPR, the term ‘construction product’ means any product or kit which is produced and placed on the market for incorporation in a permanent manner in construction works or part thereof and the performance of which has an effect on the basic requirements of the construction works.”

COMPONENT:

is a part of a building, for example a floor. This is composed of various building products, e.g. insulation, screed, primer, adhesive and parquet. The component as a whole must form a functional unit.

SUSTAINABILITY:

The GEV’s use of the term ‘sustainability’ is primarily based on the widely used and generally accepted ‘three-pillar model’, whose holistic approach takes economic, ecological and social aspects into account. A product, technical solution or process is sustainable if its effects fit into a reasonably sized intersection (or overlap) of the three aforementioned aspects.

Concerning the sustainability of modern products, it is primarily criteria of ecological sustainability that can be documented. Social aspects (e.g. occupational safety and health, exclusion of hazardous substances) and also economic aspects (e.g. capability for renovation, technical solutions with a favorable price-[sustainability-]performance ratio) are only considered in some subareas. **Being part of the overall construction system, building products thus enable sustainability at a higher level. Their use is not an end in itself, but rather helps produce a structural component or building and can thus have an even stronger impact in terms of sustainability.**



¹REGULATION (EU) No. 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC. Journal reference: L 88 of 4 April 2011, pp. 5–43

■ Structure and types of parquet floors

Parquet flooring is essentially made of wood or a combination of wood and wood-based materials. Wood is a natural, renewable resource and therefore meets the highest sustainability requirements. As a plant-based raw material, wood has absorbed significant amounts of CO₂ from the atmosphere during its growth phase, thus contributing to the mitigation of climate change.

Parquet can be installed on many different substrates to produce a floor. The structural component ‘parquet floor’ always consists of:

- **a subfloor** (usually a mineral screed, chipboard, concrete floor or plywood)
- **a primer (if necessary), an adhesive (if necessary) and / or underlays (if necessary)**
- **parquet flooring (incl. a surface finish).**

If the parquet is firmly connected to the subfloor by means of an adhesive, this is called ‘bonded parquet’. If an underlay is installed under the parquet and the parquet is not connected to the subfloor, this is called ‘floating parquet’.

■ Parquet adhesives

Until about 130 years ago, parquet was mostly fixed by nails on wooden subfloors. Later, fire safety regulations led to the replacement of these wooden constructions and the introduction of intermediate concrete floors that were covered with screeds. Since the screeds were usually mineral-based, it was not possible to nail parquet on them. For this reason, adhesives quickly found widespread use.

■ Types of adhesives

Historically, a wide variety of adhesives was used for installing parquet:

- a) hot bitumen- and/or tar-based adhesives
- b) adhesives based on dissolved bitumen and/or tar
- c) adhesives based on polymer dispersions (e.g. polyvinyl acetates or polystyrene acrylates)
- d) adhesives based on dissolved polyvinyl acetate and modified natural resins
- e) 2C-PUR adhesives based on polyols and aromatic isocyanates (PUR = polyurethane)
- f) 2C-EP adhesives based on epoxy resins, polyurethane prepolymers and amine hardeners
- g) 1C-PUR adhesives based on isocyanate-functional prepolymers
- h) adhesives based on dispersible polymer powders with cement and/or CaSO₄*1/2H₂O
- i) adhesives based on silane-modified polymers (SMPs)

While type **d**) always contained solvents (approx. 20 to 30 wt-%), types **c**) and **g**) could partially contain solvents.



■ The EMICODE® quality seal

In order for manufacturers to be allowed to label and advertise their adhesives with the EMICODE® seal, they must commit to ensuring that their adhesives meet several environmental criteria².

■ Substance restrictions

In principle, a certain number of substances are not permitted for use in EMICODE®-labelled products. The restrictions partly depend on concentration limits, the resulting labeling under Chemicals Law and emission values. The following restrictions apply:

The product itself must **not be toxic**.

CMR substances (carcinogenic, mutagenic and reprotoxic substances) as well as SVHCs (substances of very high concern) must only be present below the quantities that would lead to labeling. They must not be detectable in an emission test.

The products are not allowed to contain the **oximes methyl ethyl ketoxime** (MEKO, butanone oxime), **methyl isobutyl ketoxime** (MIBKO) and **acetone oxime**.

The products must only contain **solvents** (boiling point < 200 °C) that result from raw material contamination. The solvent content must be less than 0.5 % by weight.

Please note: It has been decided that the boiling point limit will be raised to 250 °C in the course of the TRGS 610 revision in 2025.

Due to the constantly changing assessment of substances – mostly from less to more hazardous, manufacturers are facing a problem. Both the legislator and the GEV have therefore moved on to asking not only whether a substance is problematic, but also whether users, consumers and the environment are exposed to a possible hazard through the use of this substance. If there is no exposure and the legislator does not require labeling for products with a low substance content, it is assumed that there is no potential hazard for users, consumers and the environment.

All in all, the EMICODE® label thus achieves a very high level of ecological protection.

² GEV – Classification Criteria Requirements for Emission Controlled Installation Products, Adhesives and Building Materials and Award of the EMICODE, Version of 2022-03-02, <https://www.emicode.com/wp-content/uploads/2022/04/GEV-Classification-Criteria-02.03.2022.pdf>



■ Emission requirements

The GEV's core competence lies in the area of emissions. Compliance with the emission limits required by the EMICODE® seal is verified by independent external test laboratories in so-called chamber tests. In these tests, emission chambers are filled with standardized product samples. Emissions of VOCs into the chamber are determined after 3 (or 10) and 28 days.




In particular, the TVOC (Total Volatile Organic Compounds) resp. TSVOC (Total Semi-Volatile Organic Compounds) values are determined for the following substances:

- volatile carcinogenic (cancer-causing) substances
- volatile and semi-volatile substances.

In the most stringent class EMICODE® EC 1^{PLUS}, there are additional requirements:

Products evaluated according to EMICODE® EC 1^{PLUS} must comply with the LCI values (LCI = lowest Concentration of Interest) and the R-value of the AgBB evaluation scheme after 28 days.

Limit values for emissions

			
After 3 days TVOC [$\mu\text{g}/\text{m}^3$]	≤ 750	≤ 1000	≤ 3000
After 28 days TVOC/TSVOC [$\mu\text{g}/\text{m}^3$]	$\leq 60 / \leq 40$	$\leq 100 / \leq 50$	$\leq 300 / \leq 100$

Today's market of parquet adhesives is dominated by so-called SMP adhesives that are based on silane-modified polymers. Dispersion and 1C-PUR adhesives only play a niche role today. All these products are now also available with the most demanding EMICODE® ratings EC 1 and EC 1^{PLUS}. This ensures that EMICODE® EC 1^{PLUS}-labeled parquet adhesives meet the highest requirements for consumer and environmental protection.

Please note: Solvent-based adhesives have been largely withdrawn from the market since 2010, while bituminous and tar-based products have no longer been available since the 1970s. ³ DIN EN 16516:2020-10 Construction products: Assessment of the release of dangerous substances – Determination of emissions into indoor air; German version EN 16516:2017+A1:2020

■ Data on the environmental sustainability of parquet floors, parquet and parquet adhesives

The already existing EU Construction Products Regulation (EU-BauPVO), the draft of a revised CPR⁴ and the drafted Ecodesign for Sustainable Products Regulation (ESPR, German: Ökodesign-VO) contain criteria for environmental sustainability. The criteria mentioned there are summarized below and evaluated (as far as data is available) in relation to the entire parquet floor, the parquet flooring and the parquet adhesive in terms of hazards and benefits

Criteria:

Hazards resulting from product composition, hazardous substances / emission of hazardous gases / emission of radiation / substances hazardous to waters

Parquet floor: Hazards are generally not to be expected with the below-mentioned building materials.

Parquet flooring: Parquet mainly consists of wood or wood-based materials. For emission-controlled products, risks due to hazardous substances and their emissions are not expected.

Parquet adhesive: For EMICODE®-labeled products, emissions to an extent worth consideration are not to be expected. Thanks to a reduced need for ventilation and therefore lower heat losses, a pleasant room climate can be maintained. Thus, EMICODE®-labeled parquet adhesives enable significant energy savings due to a reduced demand for heating energy. Furthermore, the risk of illnesses that can be summarized under the term 'sick building syndrome' is reduced. The hazards arising from the ingredients have already been explained above.

Criteria:

Benefits derived from the product composition, amount of recycled materials

Parquet floor: determined by parquet flooring and parquet adhesive

Parquet flooring: Wood is a renewable resource, a recycled material made from CO₂ and H₂O

Parquet adhesive: The majority of parquet adhesives is sold in polypropylene (PP) containers. PP containers usually consist of 75 to 100 % recycled plastics. The adhesive itself is not recycled. Most important requirement: The adhesive must not compromise the recyclability of the other building materials.

⁴ Proposal for a Regulation laying down harmonised conditions for the marketing of construction products, amending Regulation (EU) 2019/1020 and repealing Regulation (EU) 305/2011, Journal reference: <https://ec.europa.eu/docsroom/documents/49315>

⁵ Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EG. Journal reference: <https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX:52022PC0142>

Criteria:

Production phase and use phase; energy efficiency / resource efficiency / PCF (Product Carbon Footprint) / PEF (Product Environmental Footprint)

Parquet floor: Parquet flooring and parquet adhesive

Parquet flooring: With bonded installation, also 'thin' types of parquet such as mosaic parquet and 10-mm parquet can be used, thus saving the natural resource wood.

Parquet adhesive: The adhesive increases the thermal conductivity of the floor structure. It is therefore possible to decrease the flow temperature of underfloor heating systems by about 2 °C. This makes energy savings possible. Since the adhesive is a low-emission product, ventilation and therefore energy consumption of the building can be reduced.

Criteria:

Use phase, durability / reliability / retrofittability / maintenance / reprocessing / reparability

Parquet floor: Installation by professional craftsmen guarantees long use, maintenance and reparability.

Parquet flooring: Parquet has a very long service life, especially when bonded to the substrate. It can be repaired and redesigned (e.g., by replacing old elements, sanding and new surface treatment).

Parquet adhesive: The adhesive increases the mechanical load-bearing capacity of tongue and groove joints, thus extending the service life of the parquet flooring by approx. 50 to 100 %. The parquet surface can be sanded and newly designed more frequently. Adhesives based on polypropylene oxide (including all SMP and some PUR parquet adhesives) can undergo oxidative degradation at different rates, depending on formulation, substrate and conditions of use. These adhesives therefore usually contain compounds that protect against oxidative degradation.

Criteria:

End-of-life (or disposal) phase; waste generation / recycling / reuse / proper disposal

Parquet floor: With the exception of flooring installation materials, including the adhesive, all other components can be recycled or reused.

Parquet flooring: The parquet type determines the type of use. The adhesive does not prevent the removal of the parquet from the screed. Solid parquet can be reused after cleaning (if or where applicable).

Parquet adhesive: The adhesive must not compromise the recyclability of the other building materials.

■ Final assessment

Modern parquet adhesives offer the following benefits:

- Use of parquet in modern buildings with accepted fire hazards
- Use of parquet on large surfaces, without technical complaints caused by an excessive number of open joints and/or warpage
- Prolongation of the parquet life due to floor stabilization. The result: The floor needs less sanding during renovation, thus enabling a higher number of possible renovations and new coatings.
- Increase of the thermal conductivity of the floor structure for a more effective use of underfloor heating and cooling
- Reduction of room sound due to the bonded installation of the parquet
- Low or very low emissions of VOCs



Green building certification systems that take ecological aspects into account (such as DGNB, LEED, BREEAM or QNG) assess parquet adhesives primarily by their emissions, i.e. not by their intrinsic properties, but by their impact on the building. This is based on the knowledge that the environmental impact caused by the production and provision of adhesives is insignificant compared to that of other building materials.

High-emission products, on the other hand, may lead to subsequent environmental problems and can make the utilization of the building problematic or even impossible.

In the use phase, potential emissions from the parquet adhesive play a major role: Even low emissions can trigger negative reactions by contributing to the 'new building odor' or the 'sick building syndrome'.

With EMICODE®-certified building products, it is also possible to meet the planned ventilation requirements for the residents. Additional active ventilation in summer or winter, with the resulting higher energy demand for cooling or heating, is then no longer necessary.