ENVIRONMENTAL PRODUCT DECLARATION

in accordance with /ISO 14025/ and /EN 15804/

Owner of the declaration	GDA - Gesamtverband der Aluminiumindustrie e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GDA-2019132-IBG1-EN
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Valid to	15/01/2025

Aluminium Composite Panels

GDA – Gesamtverband der Aluminiumindustrie e.V.

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com

1. General Information

GDA - Gesamtverband der Aluminiumindustrie e.V.

Aluminium Composite Panels

Programme holder
IBU - Institut Bauen und Umwelt e.V.
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Germany

Owner of the declaration
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Fritz-Vomfelde-Strasse 30
40547 Düsseldorf
Germany

Declaration number
EPD-GDA-2019132-IBG1-EN

Declared product/declared unit
1 m² aluminium composite panels

This declaration is based on the following product category rules:
Products manufactured from aluminium and aluminium alloys, 07/2014
(PCR tested and approved by the independent advisory board (SVR))

Scope:
This document relates to the manufacture of 1 m² of aluminium composite panels. This is a model EPD based on 5 products from 2 member companies weighted according to the quantities production. It can be assumed that the representativeness of the data is good due to the comparable production technologies of the individual companies. The data was collected during 2017.

The owner of the declaration is liable for the basic information and supporting evidence; any liability of the IBU in relation to manufacturer's information, LCA data and supporting evidence is excluded.

Issue date
16/01/2020

Valid to
15/01/2025

Verification

European standard /EN 15804/ serves as the core PCR
Verification of the declaration and statements by an independent body in accordance with /ISO 14025:2010/
☐ internal ☒ external

Dipl. Ing. Hans Peters
(President of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Executive Director IBU)

Dipl. Natw. ETH Sascha Iqbal,
Independent verifier appointed by SVR

2. Product

2.1 Product description/Product definition

Aluminium composite panels are thin, symmetrically constructed sandwich panels consisting of aluminium cover sheets and a thermoplastic core. The aluminium composite panels manufactured are semi-finished products for the construction industry, automotive and marine applications, rail vehicles, etc. (e.g. for façades, cladding, furniture and much more).

There is no harmonized European standard (ENh) for aluminium composite panels.
The respective national regulations apply to use of the product at the use location, in Germany for example the /building regulations of the federal states/ and the technical regulations based on these regulations.

2.2 Application

Aluminium composite panels are deployed as light cladding elements for curtain-wall facings (/DIN 18516-1/), soffits, roofs and wall cladding indoors as flat or curved panels. Aluminium composite panels are also suitable for large-scale applications with demanding requirements with regard to evenness and rigidity.

2.3 Technical data

The constructional data presented here is relevant for the product.

Constructional data

Name	Value	Unit
Thermal expansion coefficient /ISO 6892-1/	24	$10^{-6}K^{-1}$
Elasticity coefficient /ISO 6892-1/	70000	N/mm^2
Yield strength Rp 0.2 min. /ISO 6892-1/	>= 90	N/mm^2
Tensile strength Rm min. /ISO 6892-1/	>= 130	N/mm^2

Elongation at break A5 min. /ISO 6892-1/	5	%
Normally flammable aluminium composite panels	-	-
3 mm panel weight (measurement)	0.045	kN/m²
4 mm panel weight (measurement)	0.055	kN/m²
6 mm panel weight (measurement)	0.075	kN/m²
Flame-retardant / non-combustible aluminium composite panels	-	-
3 mm panel weight (measurement)	0.060	kN/m²
4 mm panel weight (measurement)	0.075	kN/m²
6 mm panel weight (measurement)	0.11	kN/m²
All panel types	-	-
3 mm panel rigidity EI	1250	kNcm²/m
4 mm panel rigidity EI	2400	kNcm²/m
6 mm panel rigidity EI	5900	kNcm²/m
3 mm section modulus W	1.25	cm³/m
4 mm section modulus W	1.75	cm³/m
6 section modulus W	2.75	cm³/m

There is no harmonized European standard (ENh) for aluminium composite panels and there for no CE-mark for the product. Hence the declaration of performance (DoP) is subject to national regulations.

2.4 Delivery status

Preferred dimensions unit

	Min	Max	Vorzugsmaß	Einheit
Dicke	2	8	4	mm
Breite	–	2050	1250 - 1500	mm
Länge	–	12000	2500 - 6000	mm

2.5 Base materials/auxiliary materials

Composition in weight percentages

Name	Value	Unit
Aluminium	32 - 49	%
Core layer	33 - 61	%
PE film	4 - 27	%

Aluminium composite panels are thin sandwich panels (2-8 mm) with aluminium cover sheets (approx. 0.5 mm):

- mill finish in accordance with /EN 485-2/, see EPD entitled "Bare metal aluminium sheet" (Declaration number: EPD-GDA-2019129-IBG1-EN);
- coil coated in accordance with /EN 1396/, see EPD entitled "coil coated metal aluminium sheet" (Declaration number: EPD-GDA-2019131-IBG1-EN)
- generally with a thermoplastic core binder, e.g. modified polyethylene (PE) as well as ethyl vinyl acetate (EVA).

Aluminium hydroxide is used as a flame retardant on aluminium composite panels which originates from the hydroxides group.
Typical aluminium alloys for the construction industry comply with the 3000 and 5000 series in accordance with /EN 573-3/.
A conversion coating is applied to treat surfaces before painting. This may contain chromate or chrome (III) or be chrome-free.
The varnishes used are polyester-based. The base originates from the reaction of carboxylic acids with alcohols.
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Does the product contain substances which are on the candidate list /(date 16/07/2019) at a mass concentration above 0.1 %: no

Does the product contain further Category 1A or 1B CMR materials which are not on the candidate list at a mass concentration of above 0.1% in at least one partial product: no

Were biocidal products added to this building product or was it treated with biocidal products (is this therefore a processed product in terms of the /Biocide Product Directive/): no

2.6 Manufacturing

Generally, rolled ingots are cast from the application-specific aluminium alloy using the continuous casting method. These rolled ingots are pushed between two rotating steel rollers which are spaced slightly less far apart than the thickness of the rolled material. The rollers pick it up due to friction and compress it to the distance between the rollers. This forming takes place above all longitudinally so that the rolled material becomes elongated. Several rolling sequences are usually necessary to reach the final thickness. Thermal treatment may be carried out as required to achieve the desired material properties with regard to workability and rigidity. The aluminium strips are coated to final width in a continuous varnish application (coil coating). Solvents used in the process are collected and thermally recycled for curing the varnish. The coated strips are then laminated and cut to length in a further process with a continuously produced core (e.g. extrusion).

2.7 Environment and health during use

In recent years, the European semi-finished aluminium goods industry has successfully made great efforts to conserve the environment and resources.
For example, continuous optimisations of the rolling and coating processes for aluminium panels make a contribution to resource efficiency (/European Aluminium Association 2018/). This is ensured by management systems (such as /ISO 14001/, /ISO 50001/ and /ISO 45001/) and continuously monitored by accredited certification bodies.
The coating requires the use of organic and inorganic solvents. Solvent vapours which are produced are recycled thermally by burning on the works site. No further measures beyond those which are legally prescribed are necessary during the manufacture of aluminium composite panels.

Sound protection

An improvement in airborne sound insulation of up to 12 dB can be achieved for a 200 mm thick aerated concrete wall with Rw,R = 44 dB with a curtain-wall

facing with air space with 12 cm fibre insulation and cladding with 4 mm aluminium composite panels (in accordance with /ISO 10140-1/). The damping behaviour (e.g. drumming noises from driving rain) is better by a factor of 5 to 10 than with a comparable solid aluminium sheet (to /ISO 6721-1/).

2.8 Product processing/installation

Aluminium composite panels are cut to size with a circular saw. Composite panel edges are milled v-shaped on the rear side with conventional woodworking machines. Angling is done by hand. The cut edges do not need to be sealed as the material is ductile. No specific environmental protection measures are necessary when working aluminium composite panels. The general work protection and health instructions for building sites apply.

2.9 Packaging

Polyethylene (PE) films, wooden pallets and plastic tape are used as packaging materials. After use the packaging materials can be reused or recycled. Wooden pallets, plastics and paper can therefore be collected separately and recycled.

2.10 Condition of use

The product remains unchanged during its use phase. With appropriate use of the product, no change in material composition either during working or during use is to be expected.

2.11 Environment and health during use

No effect relationships with regard to the environment and health are known if aluminium composite panels are used appropriately.

2.12 Reference period of use

The period of use for many aluminium composite panels in the construction sector is frequently determined by the building's period of use. Repair and maintenance are minimal due to the self-passivating surface. With appropriate use, a period of use of more than 70 years can be assumed.

2.13 Extraordinary influences

Fire

Building material class to / EN 13501– 1/:

- non-combustible A2, s1, d0 demonstrably without toxic flue gases
- flame-retardant, B, s1, d0
- normally flammable D/E

Fire-retarding core materials with a fire and smoke-resistant effect.

Water

Surfaces are inert and do not wash out any or at least any significant quantities of hazardous substances even in a worst case scenario. Aluminium composite panels therefore do not represent any hazard for the soil, surface or ground water ES3 in accordance with EU Construction Projects Directive No. 305/2011.

Mechanical destruction

All materials remain in a bounded state following mechanical destruction.

2.14 End-of-life phase

Dismantling

The façade elements and flat panels can be removed non-destructively depending on the mounting system by unscrewing them or drilling out the rivets.
Non-destructive dismantling of panels which have been glued in place is not generally possible.

Reuse and further use

The dismantled products can be reused in undamaged form in accordance with their original designated purpose.
If correctly sorted, the elements can for example be separated by shredding and the aluminium and the core recycled after being prepared.
If recycling just aluminium, the core material supports the smelting process.

2.15 Disposal

There is no specific /European Waste Catalogue/ waste code for aluminium composite panels which have been dismantled. Assignment to EAK 17 09 04 is possible.
Amongst other things, aluminium composite panels are accepted by scrap dealers based on up-to-the-minute aluminium scrap prices.

2.16 Further information

Further information is available at:
www.aluinfo.de.

3. LCA: Calculation rules

3.1 Declared unit

The declared unit relates in each case to 1 m² of average aluminium composite sheets 4mm thick and weighing 7.04 kg.

Specification of the declared unit

Name	Value	Unit
Declared unit	1	m^2
Conversion factor to 1 kg	0.142	-

3.2 System boundary

EPD type: Cradle to gate with options.
This LCA includes the lifecycle stage of product manufacture and also end of life (EoL).

- The product stage covers Module A1 (Raw materials provision), A2 (Transport) and A3 (Manufacture).
- The EoL includes environmental effects which occur due to waste treatment (material recycling of aluminium composite panels). The quantity of aluminium which is recycled

(material for recycling, MFR) and the thermal recycling of the core material are declared in C3. The material losses assumed are balanced out in C4.

- Credits from reuse, recovery and recycling potential are shown in Module D in accordance with /EN 15804/.

Due to the low environmental influence of the packaging, its disposal was cut off in Module A5 and the end-of-life of the packaging was not included (cut-off).

3.3 Estimations and assumptions

It is assumed that the composite panels are recycled after expiry of the use phase. There is only a credit for the metal. No credit is given for the core material.
The date record from the EPD entitled "Coil coated aluminium sheet" (Declaration number: EPD-GDA-2019131-IBG1-DE) was used for the pre-product.
It is assumed that the aluminium ingots are transported a distance of 350 km to the place of manufacture. This assumption is based on empirical values from the Federation.

3.4 Cut-off rules

All operating data collected was included in the balance. Processes whose total contribution to the final result by mass and in all impact categories examined is less than 1% were ignored. It can be assumed that the ignored processes contribute less than 5 % each to the impact categories included.

3.5 Background data

The /GaBi 8/ software system for an integrated approach developed by thinkstep was used to model the life-cycle of the product under examination. The consistent data in the /GaBi database/ is documented and can be viewed online at http://www.gabi-software.com/international/support/gabi/gabi-database-2018-lci-documentation/.
The base data in the /GaBi database/ was used for energy, transport and auxiliary materials.

3.6 Data quality

The data collected by the members of European Aluminium (EA) from the production year of 2015 was used to model the aluminium upstream chain. The background data used was taken from the database behind the /Gabi 8/ software. The background data used is not more than 5 years old.

3.7 Period under review

The data basis for this LCA is based on data collected in 2017. The period under review is 12 months.

3.8 Allocation

The quantity of scrap required for manufacturing is first deducted from the aluminium scrap accruing in the system from production and in end-of-life. The system's net quantity of scrap is thus calculated, i.e. The quantity of scrap which exceeds the system boundary.
This results in a credit with primary material less the costs for re-smelting. This credit (substitution of primary material) is assigned to Module D taking into account a recovery rate (recycling rate 85%).

3.9 Comparability

In principle, a comparison or the evaluation of EPD data is only possible if all data to be compared was compiled in accordance with /EN 15804/ and the building context or if product-specific performance characteristics have been included.
The /GaBi- database/ was used to model the product lifecycle.

4. LCA: Scenarios and further technical information

The end-of-life for average aluminium composite panels consists of 85 % recycling and 15 % disposal in landfill with the corresponding credits and loads. Disposal of the packaging in Module A5 was ignored due to its small influence (cut-off).

Module D contains the costs of recovery (re-smelting) and also credits to the value of costs for primary material.
The credits and loads used are based on a Europe-wide average for aluminium scrap and not inherently on the specific scrap value of the composite panels manufactured.

End-of-life (C4)

Name	Value	Unit
To landfill	15	%

Reuse, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
Recycling rate	85	%

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

Production stage			Construction process stage		Use stage							End of life stage				Credits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	X	X	X	X

RESULTS OF THE LCA – ENVIRONMENTAL IMPACTS: 1 m² aluminium composite panel

Parameter	Unit	A1-A3	C2	C3	C4	D
Global warming potential	[kg CO_2 eq.]	2.67E+1	4.09E-2	8.26E+0	4.13E-2	-1.63E+1
Depletion potential of the stratospheric ozone layer	[kg CFC11 eq.]	2.44E-10	1.13E-15	9.02E-14	9.15E-15	-1.64E-10
Acidification potential of land and water	[kg SO_2 eq.]	1.00E-1	1.71E-4	1.77E-3	2.44E-4	-6.36E-2
Eutrophication potential	[kg $(PO_4)^{3-}$eq.]	7.43E-3	4.36E-5	3.52E-4	3.37E-5	-4.58E-3
Formation potential for tropospheric ozone photochemical oxidants	[kg Ethene eq.]	6.11E-3	-6.39E-5	1.04E-4	1.90E-5	-3.54E-3
Abiotic depletion potential for non-fossil resources	[kg Sb eq.]	1.13E-5	3.39E-9	2.75E-7	1.58E-8	-7.28E-6
Abiotic depletion potential for fossil resources	[MJ]	4.20E+2	5.61E-1	1.95E+0	5.33E-1	-1.83E+2

RESULTS OF THE LCA – RESOURCE USE: 1 m² aluminium composite panel

Parameter	Unit	A1-A3	C2	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	1.02E+2	3.11E-2	3.81E-1	6.86E-2	-7.84E+1
Renewable primary energy resources as material utilisation	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	1.02E+2	3.11E-2	3.81E-1	6.86E-2	-7.84E+1
Non-renewable primary energy as energy carrier	[MJ]	4.49E+2	5.63E-1	2.15E+0	5.53E-1	-2.12E+2
Non-renewable primary energy resources as material utilisation	[MJ]	1.33E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	4.62E+2	5.63E-1	2.15E+0	5.53E-1	-2.12E+2
Use of secondary materials	[kg]	9.89E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	7.90E-10	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	9.27E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m³]	2.74E-1	5.72E-5	1.99E-2	1.05E-4	-1.73E-1

RESULTS OF THE LCA: OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² aluminium composite panel

Parameter	Unit	A1-A3	C2	C3	C4	D
Hazardous waste disposal	[kg]	2.43E-4	3.26E-8	5.61E-9	9.53E-9	-1.39E-7
Non-hazardous waste disposal	[kg]	5.18E+0	4.72E-5	2.66E-1	2.60E+0	-3.51E+0
Radioactive waste disposal	[kg]	1.66E-2	7.71E-7	7.94E-5	7.95E-6	-1.14E-2
Components for reuse	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	1.41E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	3.11E+1	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

Modules A1-A3 bear the main environmental loads of the lifecycle. Pre-production provision for the manufacture of aluminium composite panels dominates in all impact categories. The influence is to be classified as significant (> 50 %).

Compared to the old EPD from 2013, the global warming potential in the manufacturing phase is significantly reduced as approximately 43 % of secondary material is used in the aluminium composite panels. The environmental effects have been reduced in all further impact categories through the increased secondary share. By contrast, the environmental effects of energy use and the plastic core are insignificant in all impact categories (< 10%).

In the end-of-life it is assumed that the aluminium and the core material are mechanically separated. The thermal recycling of the core material has a relevant effect in the end-of-life.
The credit in the end-of-life results from the material recycling of the aluminium sheet. The energy used for recycling aluminium is up to 95% less compared to primary manufacture.

7. Requisite evidence

The weathering of roof and façade products is subject to several influencing factors.
In addition to the alloy and surface coating, the environment (industry, seaside, etc.) and the regional weather situation and local environmental influences are all influencing factors.

The erosion of the surface can only be specifically measured on the respective object.

8. References

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