ENVIRONMENTAL FACT SHEET

ETFE film: Fluon®ETFE

Scope of the study

This study was carried out by thinkstep corporation according to EN15804. This assessment considers the Cradle to Gate result for ETFE film production. Primary data was collected from Asahi Glass Company's (AGC) sites in Japan for the production year 2014. This production data was used to model the ETFE film production process. Upstream data on raw materials and energy came from thinkstep's GaBi software. The LCA was carried out for the manufacturing phase of the products, taking into account all background data such as raw material production and transportation ("cradle to gate").

Product description

Fluon ETFE FILM is made from a thermoplastic fluoropolymer developed and manufactured by AGC. The Film features excellent transparency and resistance to heat, chemicals and weather. It also boasts strong electrical Insulation and non-sticking properties. AGC offers a range of different thickness options, clear or diffused light transmission performance along with colored and printed ETFE film types. By using a combination of different types of film, you are able to control light and solar heat transmission in architectural applications.

Applications

Due to its exceptional durability, transparency, and antifouling properties, Fluon ETFE FILM is used in a wide range of applications. These performance applications include innovative architectural functional designs, mold release film for electronic component processing, interior wall covering protection, solar module insulation, high performance greenhouses covering and a whole host of other innovative uses.

ETFE Film is much lighter and flexible than traditional glass façades or roof coverings. Fluon ETFE film has become a very innovative and proven as a construction material for architectural applications.

Technical data

Technical data for a thickness of 250 µm and an area weight of 437.5 g/m²:

Parameter	Value	Unit
Material Thickness in accordance DIN-53370 ISO-459	250±13	µm
Tensile Stress at Break in accordance DIN-EN-ISO-527-3	50 min.	MPa
Tensile Strain at Break in accordance DIN-EN-ISO-527-3	350 min.	%
Tensile Stress at 10% Strain in accordance DIN-EN-ISO-527-3	18 min.	MPa.
Tear Strength in accordance DIN-EN-1875-3	400 min.	N/mm
Light Transmittance in accordance DIN-EN-410	87 min.	%

LIFE CYCLE ASSESSMENT

Declared unit

This study relates to a declared unit of 1 m² film with an area weight of 437.5 g/m².

System boundaries

For this life cycle assessment the production of the film has been taken into account (cradle-to-gate, modules A1-A3 according to EN 15804):

- Raw materials (granulate, pigments)
- Transport of raw materials to production site
- Production of packaging materials
- Production process of foil on site

Estimations and assumptions

The following estimations have been considered for this study:

- Result is average value of AGC production site in Japan.

Cut-off rules

All data referring to the production in 2014 have been taken into account for the life cycle assessment.

Production of capital equipment, facilities and infrastructure required for manufacture are outside the scope of this assessment.

Data and software

This life cycle assessment has been modelled with the software GaBi 6 of thinkstep AG.

Verification This fact sheet has not been verified externally.

ENVIRONMENTAL INDICATORS

Global Warming Potential (GWP): global warming impact of greenhouse gases such as Carbon Dioxide (CO_2), measured using the equivalent CO_2 emission over a 100 year time horizon.

Acidification Potential (AP): increase of soil and water acidity that the product can cause compared to sulphur dioxide (SO_2).

Eutrophication Potential (EP): impact of nutrification by nitrogen and phosphorus to aquatic and terrestrial ecosystems, for example through algal blooms, disturbing the balance between species, measured relative to emissions of phosphate (PO_4^{3-}).

Photochemical Ozone Creation Potential (POCP): also known as summer smog, the impact from oxidizing of volatile compounds in the presence of nitrogen oxides (NOx) which frees ozone in the low atmosphere, measured relative to Ethene (C_2H_4).

Ozone Depletion Potential (ODP): relative impact that the product can cause to the stratospheric ozone layer, compared to an emission of trichloro difluoro methane (CFC11).

Abiotic Depletion Potential elements (ADPE): impact from the depletion of scarce non-renewable resources such as metals, expressed in comparison to the element antimony.

Abiotic Depletion Potential fossil (ADPF): impact from depletion of fossil fuel resources such as oil or natural gas, expressed using their net calorific value.

Primary Energy (PERT / PENRT): total energy resources required to manufacture the product. Sources of non-renewable energy are fossil fuels and uranium, and sources of renewable energy are biomass, wind, solar or hydraulic sources.

RESULTS OF THE LIFE CYCLE ASSESSMENT

Illustration according to EN 15804

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² ETFE foil

Indicator	Abbr.	Unit	Production (A1-A3)
Global warming potential	GWP	[kg CO_2-eq.]	9.13E+00
Ozone Depletion Potential	ODP	[kg CFC11-eq.]	1.05E-04
Acidification Potential	AP	[kg SO_2-eq.]	1.94E-02
Eutrophication Potential	EP	[kg PO_4^{3-}-eq.]	1.41E-03
Photochemical Ozone Creation Potential	POCP	[kg Ethen-eq.]	2.40E-03
Abiotic Depletion Potential elements	ADPE	[kg Sb-eq.]	1.29E-05
Abiotic Depletion Potential fossil	ADPF	[MJ]	1.28E+02

RESULTS OF THE LCA - RESOURCE USE: 1 m² ETFE foil

Indicator	Abbr.	Unit	Production (A1-A3)
Primary energy renewable used as energy	PERE	[MJ]	4.46E+00
Primary energy renewable used as raw materials	PERM	[MJ]	0.00E+00
Primary energy renewable total	PERT	[MJ]	4.46E+00
Primary energy non-renewable used as energy	PENRE	[MJ]	1.25E+02
Primary energy non-renewable used as raw materials	PENRM	[MJ]	6.83E+00
Primary energy non-renewable total	PENRT	[MJ]	1.32E+02
Use of secondary material	SM	[kg]	0.00E+00
Use of renewable secondary fuels	RSF	[MJ]	0.00E+00
Use of non-renewable secondary fuels	NRSF	[MJ]	0.00E+00
Use of net fresh water	FW	[m³]	4.30E-02

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² ETFE foil			
Indicator	**Abbr.**	**Unit**	**Production (A1-A3)**
Hazardous waste disposed	HWD	[kg]	1.55E-05
Non-hazardous waste disposed	NHWD	[kg]	5.82E-02
Radioactive waste disposed	RWD	[kg]	1.44E-03
Components for re-use	CRU	[kg]	0.00E+00
Materials for recycling	MFR	[kg]	0.00E+00
Materials for energy recovery	MER	[kg]	0.00E+00
Exported electrical energy	EEE	[MJ]	0.00E+00
Exported thermal energy	EET	[MJ]	0.00E+00