IFS Coatings

Gainesville, Texas
3601 N Interstate 35, Gainesville, TX 76240
www.ifscoatings.com | coatingsinfo@ifscoatings.com

Facilities represented

This declaration represents the production of IFS High Performance Fluoropolymer Polyester Coatings at the following locations:

- **Gainesville, Texas**
  3601 N Interstate 35, Gainesville, TX 76240
- **Ardmore, Oklahoma**
  3430 Cypert Way, Ardmore, OK 73401

EPD Number and Period of Validity

Valid: November 21, 2016 – November 20, 2021
SCS-EPD-04251

Product Category Rule

Architectural Coatings: NAICS 325510

Functional Unit

The functional unit is 1 m^2 (square meter) of coating to cover and protect a substrate for a period of 60 years.

Units and Quantities

In accordance with the PCR, the international systems of units (SI units) are used and all quantities are represented with three digits expressed in scientific notation. This excludes quantities expressed as percentages.

Program Operator

SCS Global Services
2000 Powell Street, Ste. 600, Emeryville, CA 94608
+1.510.452.8000 | www.SCSglobalServices.com

Table of Contents

Disclaimers: *This Environmental Product Declaration (EPD) conforms to ISO 21930, 14025, 14040, and 14044.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD)	PCR for Architectural Coatings: NAICS 325510.
PCR review, was conducted by	Tom Gloria, PhD, Industrial Ecology Consultants (Review Chair) Email: t.gloria@industrial-ecology.com
Approved: November 21, 2016 Valid until: November 20, 2021	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930:2007.	☐ Internal ☑ External
Third party verifier	Tom Gloria, PhD, Industrial Ecology Consultants

PRODUCT DESCRIPTION

High Performance Fluoropolymers are comprised of fluorinated copolymers for excellent color and gloss retention and corrosion protection, and can be formulated over a broad range of color, gloss and special effects. High Performance Fluoropolymers are used almost exclusively for exterior applications, including commercial, residential, and monumental buildings, commercial storefronts, curtain walls, skyscrapers, hospitals, malls, government buildings and stadiums. The product lifespan scenarios in this EPD are derived from market-based and design lifetimes provided in the PCR. The lifespan scenarios and the criteria for choosing the lifespan are shown in Table 1.

Table 1. *Product lifespan scenarios for IFS High Performance Fluoropolymer (IFS 500FP) in this EPD.*

IFS Powder Coating Product	Market-Based Product Lifespan (years)	Market-Based Lifetime Criteria	Design Life Product Lifespan (years)	Design Life Criteria
Fluoropolymer	10	Exterior coating	10	Exterior coating, Gold warranty
			20	Exterior coating, Platinum warranty

IFS High Performance Fluoropolymer is manufactured to meet and exceed the American Architectural Manufacturers Association (AAMA) 2605 specifications. The AAMA specifications are voluntary specification and performance requirements with test procedures for superior performing organic coatings on aluminum extrusion and panel.

The AAMA 2605 tests that help assist the architect, owner, or contractor to specify and obtain factory-applied organic coatings that provide and maintain a good level of weatherability and general appearance are provided in Table 2. These are considered the most important general performance tests for powder coating products.

Table 2. *AAMA 2605 performance requirements for weatherability and general appearance for IFS High Performance Fluoropolymer (IFS 500FP).*

Test	Performance Requirements
Florida Exposure	10 years
Color Retention	Color change Delta E <5
Gloss Retention	Minimum 50%
Erosion Resistance	Less than 10% film loss after exposure

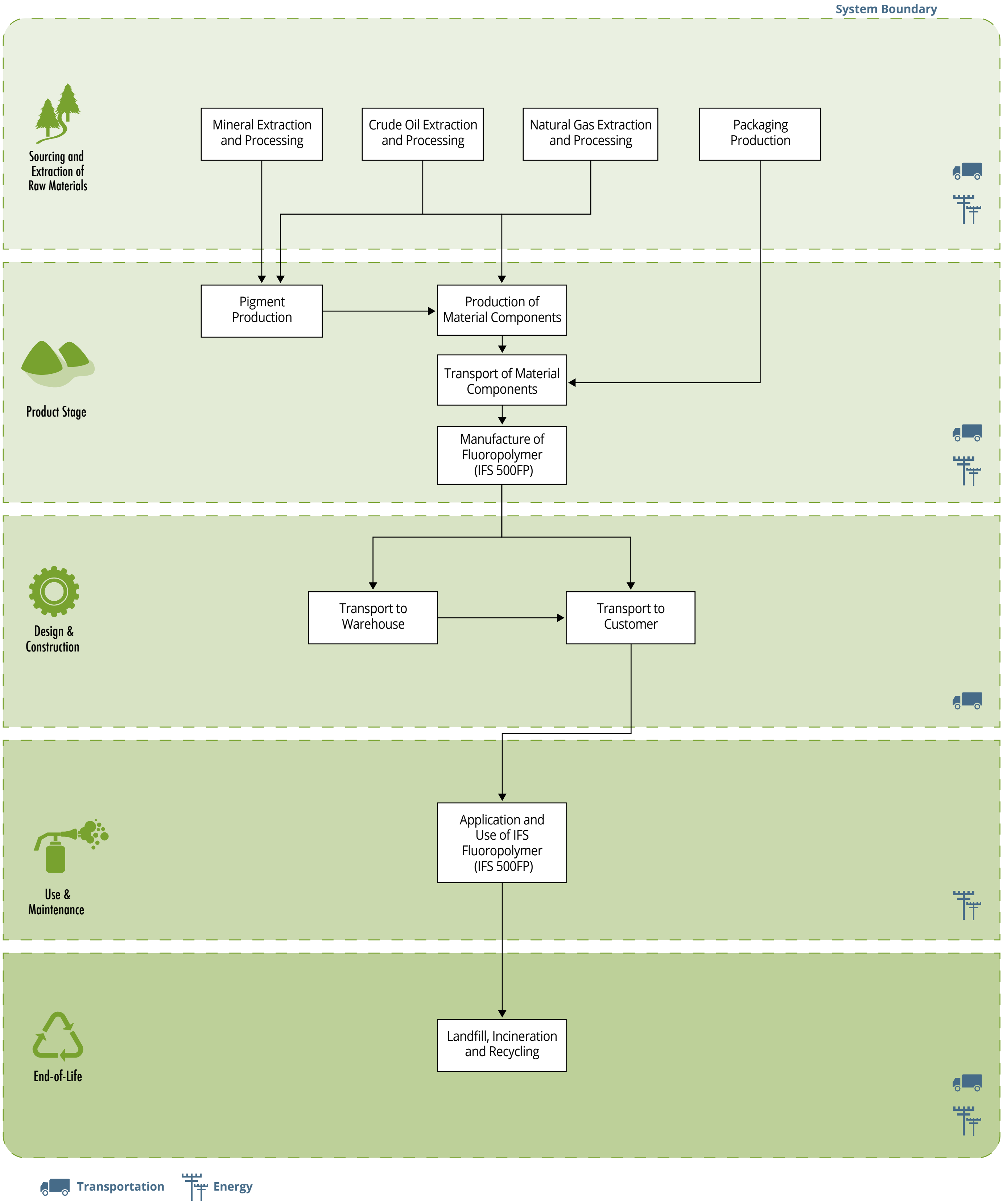
The application or transfer efficiency of powder coating to substrate is highly dependent on the size of the job, and the type and age of the system used. For this EPD, it is assumed that for architectural applications, the majority of jobs are large and automated (i.e., not sprayed by hand), and average an approximately 90% transfer efficiency. The coating exhibits 97% opacity after drying. The method to measure opacity was determined using ASTM D6441-05(2016). The amount of colorant is under the immediate control of IFS and is based on primary data.

Units and Quantities

In accordance with the PCR, the international systems of units (SI units) are used and all quantities are represented with three digits expressed in scientific notation. This excludes quantities expressed as percentages.

PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of IFS High Performance Fluoropolymer (IFS 500FP).



PRODUCT COMPOSITION

Table 3. *Material composition summary of High Performance Fluoropolymer (IFS 500FP), including packaging, as a percentage of total weight.*

Material	Percent by Weight of Packaged Final Product (%)
Fluoroethylenevinyether polymer	35-70%
Barium sulfate	19.3%
Titanium dioxide	3.18%
Chrome antimony titanate pigment	1.45%
Acrylic polymer	0.771%
Carbon black	0.578%
Red iron oxide pigment	0.433%
Benzoin	0.385%
Plastic Bag (Packaging)	3.24%
Cardboard box (Packaging)	0.409%
Other (Confidential)	-
Total	100%
Total	**100%**

LIFE CYCLE INVENTORY RESULTS

Tables 4 and 5 present the life cycle inventory parameters for IFS High Performance Fluoropolymer. Note the following:

- The waste allocated to the building product for the operations under direct control of the product manufacturer is 99.3% non-hazardous and 0.76% hazardous waste.
- The LCA study does not include measurable amounts of secondary fuel.
- There are no solvents in powder coat, and therefore no or extremely low VOCs in IFS High Performance Fluoropolymer.

Table 4. *Key life cycle inventory parameters for High Performance Fluoropolymer (IFS 500FP). Results are shown for 1 m² of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on 10 year market-based lifetime as exterior coating and a 10 year Gold warranty design life as exterior coating.*

Parameter	Unit	Total	Product Stage	Design & Construction Stage	Use & Maintenance Stage	End-of-Life Stage
Depletion of Non-renewable Energy Resources	MJ	$2.54x10^{2}$	$8.43x10^{1}$	$4.58x10^{0}$	$1.64x10^{2}$	$3.22x10^{-1}$
Depletion of Non-renewable Material Resources	kg	$7.20x10^{0}$	$2.59x10^{0}$	$9.86x10^{-2}$	$4.51x10^{0}$	$5.70x10^{-3}$
Use of Renewable Primary Energy	MJ	$8.65x10^{0}$	$4.31x10^{0}$	$5.42x10^{-2}$	$4.28x10^{0}$	$5.40x10^{-3}$
Use of Renewable Material Resources	kg	$1.03x10^{-1}$	$5.11x10^{-2}$	$1.15x10^{-3}$	$5.11x10^{-2}$	$1.39x10^{-4}$
Consumption of Freshwater	m^3	$5.92x10^{-2}$	$5.92x10^{-2}$	0.00x100	$0.00x10^{0}$	$4.36x10^{-6}$
Hydro/Wind Power	MJ	$6.42x10^{0}$	$3.18x10^{0}$	$2.88x10^{-2}$	$3.20x10^{0}$	$2.38x10^{-3}$
Fossil Energy	MJ	$2.27x10^{2}$	$7.35x10^{1}$	$4.51x10^{0}$	$1.48x10^{2}$	$3.15x10^{-1}$
Nuclear Energy	MJ	$2.69x10^{1}$	$1.07x10^{1}$	$7.09x10^{-2}$	$1.61x10^{1}$	$6.51x10^{-3}$
Bio-Energy	MJ	$2.23x10^{0}$	$1.13x10^{0}$	$2.53x10^{-2}$	$1.07x10^{0}$	$3.01x10^{-3}$
Other Energy	MJ	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$
Recycled Materials	kg	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$
Secondary Raw Materials	kg	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$	$0.00x10^{0}$

Table 5. *Key life cycle inventory parameters for High Performance Fluoropolymer (IFS 500FP). Results are shown for 1 m^2 of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on 20 year Platinum warranty design life as exterior coating.*

Parameter	Unit	Total	Product Stage	Design & Construction Stage	Use & Maintenance Stage	End-of-Life Stage
Depletion of Non-renewable Energy Resources	MJ	1.27×10^{2}	4.21×10^{1}	2.29×10^{0}	8.22×10^{1}	1.61×10^{-1}
Depletion of Non-renewable Material Resources	kg	3.60×10^{0}	1.29×10^{0}	4.93×10^{-2}	2.25×10^{0}	2.85×10^{-3}
Use of Renewable Primary Energy	MJ	4.32×10^{0}	2.16×10^{0}	2.71×10^{-2}	2.14×10^{0}	2.70×10^{-3}
Use of Renewable Material Resources	kg	5.17×10^{-2}	2.56×10^{-2}	5.76×10^{-4}	2.55×10^{-2}	6.95×10^{-5}
Consumption of Freshwater	m^3	2.96×10^{-2}	2.96×10^{-2}	0.00×10^{0}	0.00×10^{0}	2.18×10^{-6}
Hydro/Wind Power	MJ	3.21×10^{0}	1.59×10^{0}	1.44×10^{-2}	1.60×10^{0}	1.19×10^{-3}
Fossil Energy	MJ	1.13×10^{2}	3.68×10^{1}	2.25×10^{0}	$7.41\times10^{+1}$	1.58×10^{-1}
Nuclear Energy	MJ	1.35×10^{1}	5.37×10^{0}	3.55×10^{-2}	8.05×10^{0}	3.25×10^{-3}
Bio-Energy	MJ	1.11×10^{0}	5.64×10^{-1}	1.26×10^{-2}	5.36×10^{-1}	1.50×10^{-3}
Other Energy	MJ	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}
Recycled Materials	kg	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}
Secondary Raw Materials	kg	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}	0.00×10^{0}

LIFE CYCLE IMPACT ASSESSMENT RESULTS

Table 6. *LCIA results for High Performance Fluoropolymer (IFS 500FP). Results are shown for 1 m^2 of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on 10 year market-based lifetime as exterior coating and a 10 year Gold warranty design life as exterior coating.*

Impact Category	Units	Total	Product Stage	Design & Construction Stage	Use & Maintenance Stage	End-of-Life Stage
Global Warming Potential	kg CO_2 eq	$1.77x10^{1}$	$6.74x10^{0}$	$2.82x10^{-1}$	$1.06x10^{1}$	$8.04x10^{-2}$
Acidification Potential	kg SO_2 eq	$6.59x10^{-2}$	$3.13x10^{-2}$	$1.29x10^{-3}$	$3.32x10^{-2}$	$1.10x10^{-4}$
Eutrophication Potential	kg N eq	$5.23x10^{-1}$	$2.28x10^{-1}$	$3.03x10^{-2}$	$2.61x10^{-1}$	$2.76x10^{-3}$
Smog Creation Potential	kg O_3 eq	$6.45x10^{-2}$	$2.18x10^{-2}$	$3.17x10^{-4}$	$3.54x10^{-2}$	$6.97x10^{-3}$
Ozone Depletion Potential	kg CFC-11 eq	$1.71x10^{-6}$	$5.10x10^{-7}$	$6.86x10^{-8}$	$1.13x10^{-6}$	$4.62x10^{-9}$

Table 7. *LCIA results for High Performance Fluoropolymer (IFS 500FP). Results are shown for 1 m^2 of covered and protected substrate for a period of 60 years exhibiting 97% opacity after drying. Based on 20 year Platinum warranty design life as exterior coating.*

Impact Category	Units	Total	Product Stage	Design & Construction Stage	Use & Maintenance Stage	End-of-Life Stage
Global Warming Potential	kg CO_2 eq	$8.86x10^{0}$	$3.37x10^{0}$	$1.41x10^{-1}$	$5.31x10^{0}$	$4.02x10^{-2}$
Acidification Potential	kg SO_2 eq	$3.30x10^{-2}$	$1.57x10^{-2}$	$6.45x10^{-4}$	$1.66x10^{-2}$	$5.50x10^{-5}$
Eutrophication Potential	kg N eq	$2.61x10^{-1}$	$1.14x10^{-1}$	$1.51x10^{-2}$	$1.31x10^{-1}$	$1.38x10^{-3}$
Smog Creation Potential	kg O_3 eq	$3.22x10^{-2}$	$1.09x10^{-2}$	$1.58x10^{-4}$	$1.77x10^{-2}$	$3.49x10^{-3}$
Ozone Depletion Potential	kg CFC-11 eq	$8.56x10^{-7}$	$2.55x10^{-7}$	$3.43x10^{-8}$	$5.65x10^{-7}$	$2.31x10^{-9}$

SUPPORTING TECHNICAL INFORMATION

System Boundaries

The system under study includes the extraction of raw materials and processing, manufacturing, delivery and installation, use, and disposal (end-of-life) of IFS High Performance Fluoropolymer. The cradle-to-grave system boundary includes all unit processes contributing measurably to the category indicator results. The life cycle stages specified by the PCR are described relative to the LCA study below.

- **Product Stage –** This stage begins with extraction and processing of all materials from nature, their delivery to the production site, and all the relevant manufacturing processes and flows, including the impacts from energy use and emissions at the facility, as well as waste and scrap generated. Production of capital goods, infrastructure, manufacturing equipment, and personnel-related activities are not included. This stage also includes the production (including transport) of primary packaging materials.
- **Design and Construction Process Stage –** This stage includes delivery of the packaged powder coating product to the point of application (downstream transportation). Point of sale infrastructure is excluded from the study.
- **Use and Maintenance Stage –** The use stage includes the application of the powder coating to an aluminum and steel architectural substrate, accounting for the assumed application efficiency, and ends with any leftover coating and discarded packaging entering the end-of-life stage. This includes curing and excludes the coating applicator. The substrate is outside the scope of the LCA.
- **End-of-Life Stage –** The end-of-life stage begins when any applied or unused coating or primary packaging is ready for disposal, recycling, reuse, etc. and ends when these materials are landfilled, incinerated, or recycled. This stage includes recycling and disposal of primary packaging.

Cut-off Criteria

No data gaps were allowed which were expected to significantly affect the outcome of the indicator results. No single flow that represented more than 1% of the total mass or energy flows was excluded. Except as noted, all known materials and processes were included in the inventory.

Data sources

Unit processes were developed within SimaPro 8.2, drawing upon data from multiple sources. Where primary upstream data were unavailable, secondary data sources were used. The sources of secondary LCI data are from the Ecoinvent and GaBi databases. Detailed descriptions of unit processes can be found in accompanying documentation. Secondary datasets with the greatest degree of representativeness were chosen. The LCI datasets shown in Table 8 are used in the LCA model to represent unit processes in the cradle-to-grave LCA.

Table 8. *Data sources used for the LCA.*

Material	Dataset	Data Source(s)	Publication Date
Materials			
Acrylic polymer	Butyl acrylate {RoW}| production | Alloc Rec, U	Ecoinvent	2015
Benzoin	Benzaldehyde {RoW}| production | Alloc Rec, U	Ecoinvent	2015
Carbon black	Carbon black, at plant/DE S (furnace black; deep black pigment – Revised 11/30/2014)	GaBi	2014
Barium sulfate	Magnesium sulfate {RoW}| production | Alloc Rec, U	Ecoinvent	2015
Titanium dioxide	Carbon black, at plant/DE S (furnace black; deep black pigment – Revised 11/30/2014)	GaBi	2014
Red iron oxide pigment	Carbon black, at plant/DE S (furnace black; deep black pigment – Revised 11/30/2014)	GaBi	2014
Fluoroethylenevinyether polymer	Polyvinylfluoride {US}| production | Alloc Rec, U	Ecoinvent	2015
Chrome antimony titanate pigment	Carbon black, at plant/DE S (furnace black; deep black pigment – Revised 11/30/2014)	GaBi	2014
Electricity (IFS facility)	Electricity, medium voltage, at grid/ERCT 2015 U	Ecoinvent	2015
Electricity (powder coating application)	Electricity, medium voltage {US}| market group for | Alloc Rec, U	Ecoinvent	2015
Packaging			
Plastic bag	Packaging film, low density polyethylene {RoW}| production | Alloc Rec, U	Ecoinvent	2015
Cardboard box	Corrugated board box {RoW}| production | Alloc Rec, U	Ecoinvent	2015
Transportation			
Truck	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO}| market for | Alloc Rec, U	Ecoinvent	2015
Ship	Transport, freight, sea, transoceanic ship {GLO}| market for | Alloc Rec, U	Ecoinvent	2015
Other			
Powder coating application	Powder coat, aluminium sheet {US} IFS Coating| powder coating, aluminum sheet | Alloc Rec, U	Ecoinvent/SCS	2015

Data Quality

The overall data quality level, based on data quality rating (DQR) was determined to be "good quality".

Table 12. *Data Quality of Life Cycle Inventory.*

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 10 years old. All of the primary data used represented an average of one year's worth of data collection. Manufacturer-supplied data are based on calendar year 2015.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Actual processes for upstream operations are primarily North American. Surrogate data used in the assessment are representative of US, European, Global, or "Rest-of-World" (average for all countries in the world with uncertainty adjusted). Datasets chosen are considered sufficiently similar to actual processes.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative datasets, specific to the type of material, are used to represent the actual processes where primary data were not available. Where datasets specific to a material component were unavailable, a proxy dataset was used.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Manufacturer data, and representative data used for upstream processes were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows. In some instances, surrogate datasets used to represent upstream processes may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded. In total, these missing data represent less than 5% of the mass or energy flows.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical, average, or similar processes and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Secondary data sources of similar quality and age are used; with a bias towards Ecoinvent for secondary data. Different portions of the cradle-to-grave product life cycle are equally considered.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use for manufacturing represent an annual weighted average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. A mass and energy balance check was completed during the data collection period. For secondary LCI datasets, Ecoinvent is used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the powder coating products and packaging is low. Primary data for upstream processes were not available; as such, the study relied upon use of existing representative datasets for these cases. These representative datasets contained relatively recent data (~10 years, or more recent), but in some instances lacked site specific representativeness. Uncertainty related to the impact assessment methods used in the study are relatively high as it includes impact potentials that lack characterization of providing and receiving environments, tipping points, or thresholds.

REFERENCES

1. AAMA 2605 "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels"
2. ASTM D6441-05(2016) Standard Test Methods for Measuring the Hiding Powder of Powder Coatings. See: http://www.astm.org/Standards/D6441.htm
3. Ecoinvent v3.2. Weidema, B.P.; Bauer, Ch.; Hischier, R.; Mutel, Ch.; Nemecek, T.; Reinhard, J.; Vadenbo, C.O.; Wernet, G, 2013, The ecoinvent database: Overview and methodology, Data quality guideline for the ecoinvent database version 3, www.ecoinvent.org
4. GaBi Database (2014). GaBi Carbon Black (furnace black; deep black pigment – Revised 11/30/2014).
5. IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.
6. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
7. ISO 14025: 2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
8. ISO 21930: 2007 Sustainability in building construction – Environmental declaration of building products.
9. NSF International Product Category Rule for Environmental Product Declarations. PCR For Architectural Coatings: NAICS 325510.
10. SCS Global Services. Life Cycle Assessment of IFS Powder Coatings for Architectural Applications. Prepared for: IFS Coatings. Date: October 2016.
11. SCS Type III Environmental Declaration Program: Program Operator Manual v7. October, 2015. SCS Global Services.
12. Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI). Bare, J., http://www.epa.gov/nrmrl/std/traci/traci.html
13. US Environmental Protection Agency. Waste Reduction Model (WARM). https://www3.epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html

For more information contact:

IFS Coatings
3601 N Interstate 35, Gainesville, TX 76240
www.ifscoatings.com | coatingsinfo@ifscoatings.com

SCS Global Services
2000 Powell Street, Suite 600, Emeryville, CA 94608 USA
main +1.510.452.8000 | fax +1.510.452.8001