



BRIGHTVIEW
TECHNOLOGIES

Sustainability Advantage in Luminaires with BVT Films

THIN FILM COMPARED TO RIGID DIFFUSER

Many luminaires employ a diffuser for aesthetic and functional reasons. Often, this is a relatively thick rigid piece of plastic – typically acrylic (PMMA) or polycarbonate (PC). BrightView Technologies manufactures thin film MLA diffusers which can replace the traditional rigid diffuser while offering significant sustainability advantage based on a dramatic reduction in material usage. With this reduction in plastic consumption, a savings in embodied greenhouse gas emissions (GHG) of over 83% is possible. This white paper explains this benefit in more detail, using publicly sourced information to quantify the potential benefit.

Replacement of Rigid Diffuser

Calculation of sustainability benefit

A typical luminaire rigid diffuser is comprised of either 1.5, 2.0, or 3.0mm thick PMMA (“acrylic”) or PC (polycarbonate). BrightView’s material, which can replace this, consists of a thin plastic film with a Micro Lens Array (MLA) UV-cured acrylate coating layer. The substrate can be either PET or PC, with typical thicknesses of 7mil or 10mil. The acrylate coating may be present on one or both sides of the film; if on both sides, the layer thickness total is approximately 0.05mm. Using these figures, along with the environmental profiles of the materials shown below, we can calculate the sustainability advantage based on a comparable area of material.

TABLE 1: Material Environmental Impacts

	PMMA	PC	PET	Acrylate Coating
GHG (kg CO ₂ -eq / kg)	15.4	14.0	6.0	0.76

* source data references shown on following page

For simplicity’s sake, we chose 1m² of diffuser material as the functional unit by which to make the comparison.

TABLE 2: GHG Savings Calculation

Type	Material	Thickness (mm)	Density (g/cm ³)	g material per m ² area	GHG (kg CO ₂ -eq)
Rigid Diffuser	PMMA	1.5	1.18	1770	27.3
		2.0	1.18	2360	36.3
		3.0	1.18	3540	54.5
	PC	1.5	1.20	1800	25.2
		2.0	1.20	2400	33.6
		3.0	1.20	3600	50.4
	PET (7mil)	0.18	1.38	245.4	1.47
	+ acrylate coating	0.05	1.10	55	0.04
TOTAL					1.51
BVT MLA Film Diffuser	<i>GHG savings over 1.5mm PMMA or PC</i>				94%
	PC (10mil)	0.25	1.20	304.8	4.27
	+ acrylate coating	0.05	1.10	55	0.04
	TOTAL				
<i>GHG savings over 1.5mm PMMA or PC</i>					83-84%

As shown, a dramatic decrease in embodied GHG emissions is possible by swapping the thick rigid diffuser material with a coated MLA film diffuser from BrightView. If replacing a rigid diffuser thicker than 1.5mm, the benefit will be even greater than shown in the calculated examples above.

BrightView has a wide range of MLA diffuser designs available; changes to the diffusion properties do not alter the calculations shown here. BrightViews' diffusers enable nearly any type of light distribution while significantly reducing plastic consumption.

Source data for Table 1: (in cases where multiple values were found, we chose the most conservative)

PMMA:

- EPIC Database https://melbourne.figshare.com/articles/dataset/EPiC_database_-_Polymethyl_methacrylate_PMMA_/9979880?file=30569709

PC:

- EPIC Database https://melbourne.figshare.com/articles/dataset/EPiC_database_-_Polycarbonate/9979877?file=30569322

PET:

Estimates found were 3.5, 4.3, 5.3, and 6.0 kg CO₂-eq / kg

- <https://www2.calrecycle.ca.gov/Publications/Download/1084?opt=dln>
- https://uni-obuda.hu/users/groller/LCA/italcsomagolas/20100312112214-FINAL_EPD_PET.pdf
- <https://stopplastics.ca/carbon-footprint-plastic>

Acrylate coating:

Estimates found were 0.47-0.67 and 0.76 kg CO₂-eq / kg for similar type of coating chemistry at equivalent thickness

- https://www.dsm.com/content/dam/dsm/furniture/en_US/documents/20.-dsm-carbon-footprint-%20-disclaimer.pdf
- https://www.kiwa.com/4afa58/globalassets/germany/veroeffentliche-epds/epd-acrylicon-056-ac_variant_paint_system_eng.pdf/

***Note that GHG calculations can be complex. The calculations above do not account for the entire life cycle impacts of the materials in question.*