

**DATA SHEET**

# PROTECTION MASK

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**TRIPLE LAYER WITH  
GRAPHENE OXIDE**



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**EVERGEIA®**

## Triple Layer Protection Mask with Graphene Oxide



## Advantages

- Triple layer protection mask with Graphene Oxide that protects against particles larger than 5 nanometers.
- Resistant to impacts and minor scratches.
- Anti-fog treatment.
- Transparent side guards.
- Fastening tape without loss of elasticity coefficient.
- Mechanism that ensures a firm fit.
- Allows simultaneous use with conventional lenses and N95 mask or face mask.

## Characteristics

Specs	Reference Values
Material identity PET(Polyethylene Terephthalate)	Average flake size 14.8mm Origin: recycled packaging
Layers	3 layers of A-B-A Coextrusion structure
Wide	378.94 mm
High	245.00 mm
Thickness	0.4 mm
Appearance	Semi-transparent lens
Weight	58 grams
Cut	Softened
Nanotechnological additive	Graphene Oxide (GO)

## Description of the protective mask

**1. Material Type:** Triple Layer PET Film with Graphene Oxide (GO)

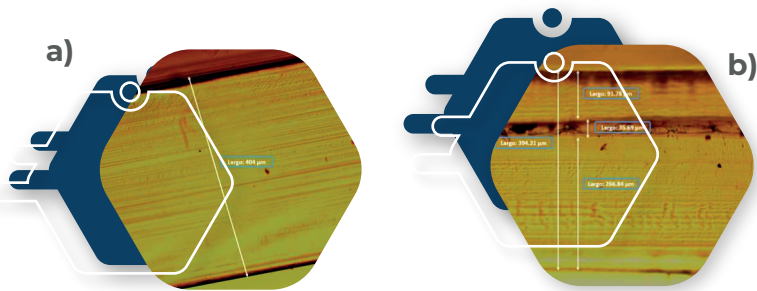
**2. GO distribution in the A-B-A coextrusion structure of the film**

External layer: A (PET w/GO)  
Intermediate layer: B (PET s/GO)  
Inner Layer: A (PET w/GO)

2.1 Determination of thickness

Film	Number of layers	Thickness(μm)	Average thickness (μm)
PET without GO	1	426.25	404.75
PET with GO	3 (A-B-A)	91.78 35.69 266.84	396.25

2.2 Distribution of the A-B-A layers in the protection mask with graphene oxide.



Optical microscopy images (Magnification: 40X) of films based:  
 a) PET without GO  
 b) PET film with A-B-A structure with GO.

**3. Physical-mechanical tests of the protection mask**

3.1 Mechanical strength

Tensile strength and yield strength tests show that GO face shield film is 20% stronger than without GO PET film. This is related to a lower risk of fracture and, therefore, a longer useful life.

Sample	Tensile strength (Mpa)	Tensile strength (Mpa)
PET without GO	39.4	42.1
PET with GO	47.4	47.7

**Tensile Strength:** Maximum stress that a material subjected to a stretching load can withstand without breaking. The tensile strength of PET with GO is 20% higher than PET without GO.

**Yield Strength:** Maximum stress that can be developed in a material without causing plastic deformation. The yield strength of PET with GO is 13% higher than PET without GO.

### 3.2 Impermeability to oxygen

The graphene oxide in the protective mask film increases the impermeability to oxygen by 18% compared to a PET without GO film. This is because GO forms a dense and organized nanonetwork that prevents the permeability of species that are as small as oxygen through the material and even hinders the anchoring and diffusion of microorganisms through it.

Table 3. Results: LS-PTR procedure for oxygen transmission through plastic film. ASTM D3985-05(2010)

Sample	Transmission speed of oxygen [cm <sup>3</sup> /m <sup>2</sup> -day]*
PET without GO	9.45987
PET with GO	7.79165

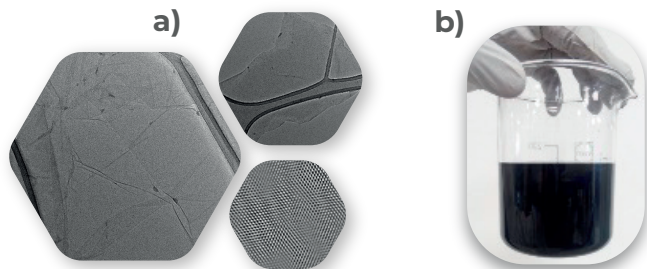
\* cm<sup>3</sup>/m<sup>2</sup>-day: oxygen transmission rate that passes through a square meter of film in a day.

Note: The increase in oxygen impermeability is at the nanotechnological level and does not affect the user's breathing capacity.

## Graphene oxide

The nanotechnological protection offered by graphene oxide is due, among other things, to its size and distribution throughout the entire PET matrix.

The size of the exfoliated GO particle in the horizontal plane is in the range of 1.0 to 5.0  $\mu\text{m}$  (1000 to 5000 nm), the distance in the vertical plane is  $>1$  nm and the distance between the carbon atoms that make it up is 0.142nm.



a) Representative images of the graphene oxide present in the protection masks.

b) Appearance of the GO in dispersion.

Equipment: HRTEM JEOL JEM-2100. Energy Dispersive Spectroscopy (EDX/EDS), Oxford, Instruments. U.A.S.L.P.

## Legal Note

The information contained in this document is believed to be correct and is not intended to be exhaustive, so it should only be used as a guide and does not represent any guarantee of the product. The properties conferred by graphene oxide in the protective masks depend on their correct handling and incorporation into the PET polymer matrix according to the conditions and specifications determined by Energeia Fusion S.A. of C.V.

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