

AEROSOL® OT Surfactant – Mold Release Agent for Methacrylic Polymers (PMMA)

Introduction

AEROSOL OT surfactant is used as a mold release agent for methacrylic polymers (i.e. principally PMMA, polymethyl methacrylate). During the production of articles based on methacrylic polymers, it is important that the final products readily release from the molds in which they are formed and shaped. This ready and easy release is important to ensure smooth and continuous production with optimal optical and physical properties. The incorporation of AEROSOL OT into the methacrylic polymers imparts outstanding mold release properties and insures the efficient production of high quality sheet, molded and composite articles.

Physical and Chemical Properties

AEROSOL OT is sodium dioctyl sulfosuccinate and is available in both solid and liquid forms. The chemical and physical properties of the product grades used as mold release agents in methacrylic polymers are as follows:

Characteristics and Properties

	AEROSOL OT-100	AEROSOL OT-B	AEROSOL OT-S
Appearance @ 25°C	Waxy solid	White granular solid	Transparent light amber liquid
Solids, % by weight	98 min.	98 min. (83% active)	70+2
Moisture, % by weight	2.0 max.	2.0 max.	0.5 max.
Solvent or diluent	-	Sodium benzoate	Light petroleum distillate
Specific gravity @ 25°C	1.1	1.1	1.0
Melting Point, °C	153-157	300	-
Solubility in organic solvents	Excellent	Insoluble	Good to excellent

Technology

A. Methacrylate Polymers and Manufacturing Processes

Most methacrylic polymers are actually copolymers, comprising acrylic and methacrylic moieties. Copolymerization greatly increases the range of available polymer properties. All acrylic polymers tend to be soft and tacky and all methacrylic polymers tend to be hard and brittle. Through judicious formulation of the various monomer components, polymers can be prepared with various degrees of hardness, flexibility and other properties. The most common manufacturing processes for the production of methacrylic polymers include bulk, solution, emulsion and suspension polymerization. Dependent upon the manufacturing process, specific grades with unique properties and characteristics are achievable.

AEROSOL OT is principally used in methacrylic polymers produced via the bulk process. Batch cell casting, continuous casting and continuous bulk represent the three main types of bulk processes. These three processes are used to produce molding and extrusion compounds, cell cast sheets and continuous sheets.

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PMMA, the most common methacrylic polymer, is made into sheets by one of three methods; batch cell, continuous or extrusion. The batch cell method is simple and easily adaptable for the manufacture of a wide variety of grades, colors and sizes. It is typically used in grades where high surface quality, maximum light transmission and maximum transparency are required. Continuous casting is more economical and is used to produce thin sheets or highly-filled grades. Extruded sheet is used for very thin and highly-specialized grades.

In the batch cell method, each sheet is cast in a mold comprising two highly-polished plate glasses separated by a flexible spacer. The mold is filled with the polymer mixture, heated to initiate polymerization, cured and cooled. After cooling the glass plates are separated from the polymer sheet. AEROSOL OT helps this separation giving polymer sheets that are free from flaws which in any subsequent molding process can cause the sheets to crack or shatter.

In the continuous casting process, monomer-polymer syrup is introduced between two parallel stainless steel belts that travel through a curing and annealing zone. At the end of the process, the polymer sheet must readily release from the stainless steel belts.

Extruded sheets and molding grades are produced by conventional polymer extrusion techniques, in which fine beads or powders are melted, passed through an extruder and shaped into sheets or molded parts.

B. Methacrylic Polymers and Applications

Methacrylic polymers find broad application in a variety of industries. Dependent upon the exact formulation and combination of monomers and additives, a variety of properties are achievable.

The most common methacrylic based polymer is polymethyl methacrylate (PMMA). Some key properties of PMMA include its outstanding optical properties, breakage resistance, high light-transmittance, weather resistance, its lightweight nature, rigidity, strength and stiffness. The product can be readily and easily shaped and is compatible with pigments and fillers. Principal markets for PMMA resins include video and computer displays, glazing, skylights, shields, guards, signs, lighting and composites for building and construction applications (e.g. bathroom fixtures, kitchen sinks, work surfaces, etc.).

C. Mold Release Agents for Methacrylic Polymers

During the manufacture of polymer products based on methacrylate polymers, it is very important that mold release agents be incorporated into the formulation to ensure the smooth release of the polymer article from the mold. This smooth release ensures the following:

- Production of high quality products with excellent aesthetics (e.g. no cracks, sink marks or other defects) and properties
- Ready release of the polymer from the mold and thus smooth and continuous operation of the manufacturing process
- No damage to final products or manufacturing equipment (e.g. no plate out)

The mold release agent acts as an interfacial coating that lowers the friction between two materials. Mold release agents are typically categorized as either internal or external types.

Internal mold release agents are mixed directly into the polymer. Internal mold release agents have minimal compatibility with the polymer and readily migrate to the surface of the polymer. Following migration, the internal mold release agent sets up a thin barrier coating between the resin and mold cavity or is present in sufficient quantity on the surface of the polymer to reduce adhesion to the mold cavity.

External mold release agents are applied as a thin layer to the surface of the mold, ensuring the easy releases of the polymer when required.

D. AEROSOL OT Surfactant as a Mold Release Agent for Methacrylic Polymers

AEROSOL OT is a highly functional, internal mold release agent for methacrylic polymers. The incorporation of 0.1 - 0.25% of AEROSOL OT Surfactant into the methacrylic polymer formulation insures the production of a final fabricated part that readily and easily releases from the mold. AEROSOL OT is used in the batch cell method, continuous casting, extrusion (i.e. molding powder) and composite processes.

Additionally, the AEROSOL OT also facilitates the release of any gaseous bubbles within the monomer solution, ensuring a final polymer article with excellent aesthetics and physical properties.

The following figures provide some information regarding the incorporation of the AEROSOL OT mold release agent into the monomer/polymer formulation and its mechanism of functionality in the various types of manufacturing processes.

Figure 1 – AEROSOL OT Incorporation into Monomer/Polymer

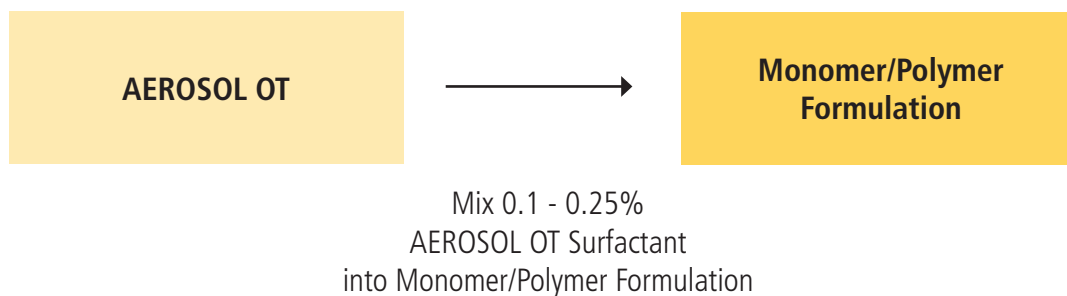
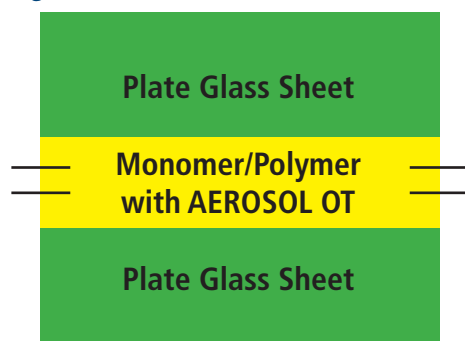
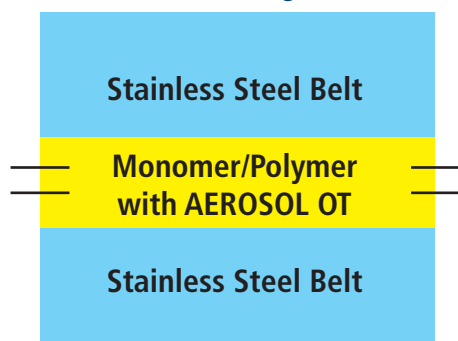


Figure 2 – Batch Cell Method – Cast Sheet



1. Monomer/Polymer formulation containing AEROSOL OT charged to mold (i.e. two plate glass sheets with a spacer).
2. Mold heated and polymer cured and cooled.
3. AEROSOL OT migrates to polymer/plate glass interphase.
4. Following cooling, polymer readily releases from mold.
5. Final polymer exhibits excellent properties.

Figure 3 – Continuous Casting Method – Cast Sheet



1. Monomer/Polymer formulation containing AEROSOL OT charged to belt (i.e. two stainless sheets with a spacer).
2. Belt heated and polymer cured and cooled.
3. AEROSOL OT migrates to polymer/stainless belt interphase.
4. Following cooling, polymer readily releases from belt.
5. Final polymer exhibits excellent properties.

The extrusion and composite processes would be similar.

Features and Benefits

The features and benefits of AEROSOL OT as a mold release agent for methacrylic polymers are as follows:

Features	Benefits
Outstanding mold release properties	Allows polymer substrate to easily and readily release from mold surface
Highly effective, functional at low concentrations	No adverse effect on polymerization or polymer properties
High purity, low salt content	Yields polymer with optimal optical and physical properties
Versatile	Functional in transparent and highly-filled sheet and molding grades
High compatibility	Easily and readily solubilized and incorporated into monomers and polymers
Highly efficient	Quick and ready release insures optimal product output and high productivity

Markets and Recommendations

Manufacturers of methacrylic polymers are encouraged to evaluate AEROSOL OT for their products. AEROSOL OT Surfactant should be incorporated at a 0.1 - 0.25% concentration based upon the weight of the polymer. AEROSOL OT is recommended for use in transparent, filled-sheet and molding grades.

Technical Service Information

Cytec Industries provides technical service assistance for AEROSOL OT Surfactant and other products. Samples are available upon request.

Health and Safety Information

Before handling this material, read the corresponding Cytec Industries Inc. Material Safety Data Sheet for safety, health and environmental data.

Storage and Handling

Handling and shipping information on this product can be found in the corresponding Cytec Industries Inc. Material Safety Data Sheet.

• Email: custinfo@cytec.com Worldwide Contact Info: www.cytec.com US Toll Free: 800-652-6013 Tel: (1+) 973-357-3193 •

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