INOLUB™ PPA

POLYMER PROCESSING ADDITIVES

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GFL™

GUJARAT FLUOROCHEMICALS

VALUE THROUGH GREEN CHEMISTRY

ABOUT
the Company

Gujarat Fluorochemicals Limited

Headquartered in Noida, India, Gujarat Fluorochemicals Limited (GFL), is a part of the INOX group of companies. The group has diversified business segments comprising chemicals, fluoropolymers, cryogenic engineering, entertainment, industrial gases and renewable energy.

An ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 and SA 8000:2014 certified organisation, GFL is a leading producer of fluoropolymers, speciality fluorochemicals, refrigerants, as well as basic chemicals for applications in a wide range of industries. GFL derives its strength from expertise in fluorine chemistry, vertical integration from natural minerals to fluoropolymers, and strong R&D, enabling it to provide our global clientele some of the best quality products in their markets, meeting all regulatory compliances.

The year 1989 marked the launch of our company's commercial operations with India's largest refrigerant manufacturing unit at Ranjitnagar, Gujarat, India. The site was further expanded to produce fluorospeciality fluorochemicals catering to the growing global demands of the agriculture and pharmaceutical industries. Foraying into new avenues in 2007, with one of the world's most integrated facilities at Dahej, Gujarat, India, and GFL now has a diverse portfolio of fluoropolymers comprising PTFE, PFA, FEP, FKM, PVDF, including fluoropolymer based additives.

With three manufacturing facilities in India, a captive fluorspar mine in Morocco, offices and warehouses in Europe and USA, and a worldwide marketing network, GFL is one of the established players in the fluoropolymer and speciality fluorochemical markets.

Our sustainability goals are interwoven with the way we do business along our entire value chain. The company is a signatory to the United Nations Global Compact (UNGC), Science-Based Targets Initiative (SBTi) and is a member of the Indian Chemical Council (ICC). Our focus on health, safety and environment is reflected in the well-being and safety of our staff and employees. All-inclusive efforts towards sustainability in all aspects of our business make us long-term partners for our customers across the globe.

Value through green chemistry

INOLUB™
Fluoropolymer Additives

INOLUB™ fluoropolymer additives are the ingredients that enable critical performance in the most demanding applications. Whether it is high-temperature grease, rub-resistant ink or coating, wear-resistant & low friction plastic component, high transparency food packaging film, or a television housing meeting stringent fire regulation - we have the right ingredients to ensure success.

INOLUB™ P Series

POLYMER PROCESSING ADDITIVES

INOLUB™ P series is a range of fluoropolymer based processing additives that can be incorporated in very low concentrations as extrusion processing aids to eliminate melt fracture and reduce die build-up.

INOLUB™ T Series

PTFE MICROPOWDERS

INOLUB™ T series is a range of finely divided low molecular weight PTFE resins to be used as additives to enhance properties of substrates including engineering plastics, elastomers, lubricants, coatings, inks and paints.

INOLUB™ R Series

RHEOLOGY MODIFIERS

INOLUB™ R series is a range of high molecular weight PTFE resins for use as additives and designed to increase the melt viscosity, to contain fire spread by the elimination of flaming droplet.

INOLUB™ Polymer Processing Additives (PPA)

INOLUB™ PPA improves the continuous extrusion processes providing better optical properties and lower manufacturing cost for the following technologies:

- Blown and cast film (LLDPE, mLLDPE, LDPE, HDPE)
- Pipe and tubing (HDPE, X-linked PE)
- Wire and cable (HDPE, X-linked PE)
- Blow moulding (HDPE)

Applications of INOLUB™ Polymer Processing Aids

INOLUB™ PPA
Advantages and Properties

INOLUB™ PPA exhibit the following improvements:

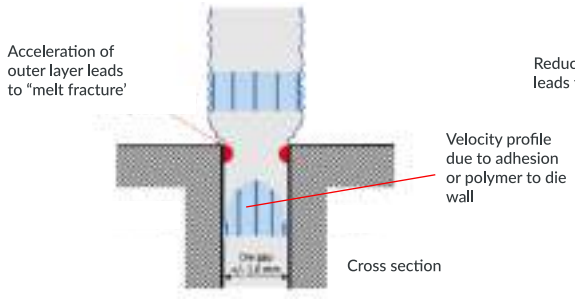
Product benefits	Processing benefits
1. Elimination of surface defects and sharkskin	1. Elimination of die build-up and gel formation
2. Better gloss and higher transparency	2. Reduction in operating pressure
3. Thinner gauge film may be achieved.	3. Higher output and lower energy consumption

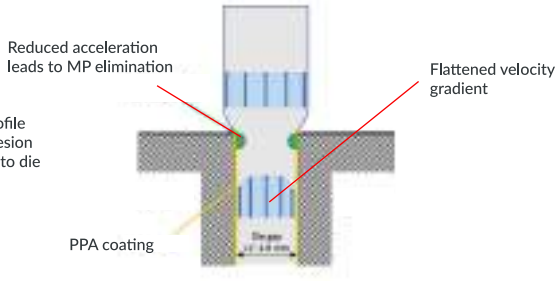
Without INOLUB™ PPA

With INOLUB™ PPA

Mechanism

Fluoropolymers characteristically have very low surface tension, excellent thermal stability and importantly, are immiscible with hydrocarbon based polymers like polyolefins. INOLUB™ PPA contains fluoropolymer which is attracted to metal surfaces, and under extrusion conditions creates a thin dynamic coating in high shear zones – particularly in the die zone. This helps with the flow of the host polymer as well as helping to eliminate "dead spots" where gels can be created and die deposit components may accumulate.





Without PPA Coating

With PPA Coating

At the die exit, the molten polymer particles attempt to reach the same velocity. The result is that the outer layer of the film has to accelerate, requiring force. This force can lead to the critical shear stress of the molten polymer being exceeded, resulting in a phenomenon known as melt fracture, which leads to "sharkskin" surface defects in the finished film. With the incorporation of INOLUB™ P, a dynamic fluoropolymer coating is created at metal surfaces, especially in the die and die exit. Melt shear is reduced, even at higher output rates, eliminating melt fracture.

Product Portfolio

	Units	INOLUB™ P501F	INOLUB™ P502F	INOLUB™ P402F	INOLUB™ P504F
Extrusion temp. range	°C	Up to 320	Up to 250	Up to 250	Up to 320
Typical use level	ppm	200 – 750	300 – 1500	200 – 1000	200 – 500
Active Ingredient	%	90	96.7	96.7	45
Inorganic Additives	%	10	3.3	3.3	5
Food contact		Yes	Yes	Yes	Yes

Grade Selection

Grade selection depends on prerequisites like melt fracture elimination, die build-up reduction or increase in output. Other additives (such as anti-block, UV stabilisers, etc.) can potentially degrade performance, requiring the PPA level has to be increased, or a higher performance grade like P402F to be used.

Other factors to be taken into account include polymer characteristics, specific extrusion technology and processing parameters.

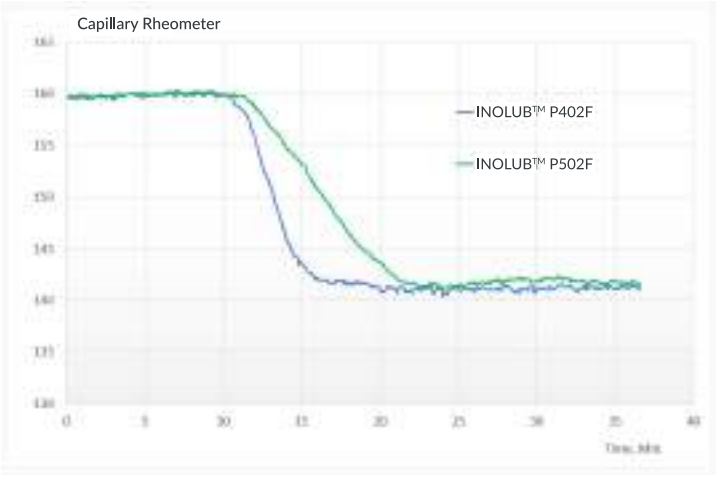
Extrusion Process	INOLUB™ PPA	Typical use level (ppm)	Main Perquisites
Blown Film Extrusion			
PE with anti-blocking and slip agents	P502F, P402F	500 – 1500	MF, DBU
PE without anti-blocking and slip agents	P502F, P402F	200 – 750	MF, DBU
PE with HALS	P502F, P402F	500 – 1500	MF, DBU
Cast Films			
LLDPE (Stretch)	P501F	100 – 300	DBU
BOPP and CPP	P501F	100 – 300	DBU
Pipe Extrusion			
Cross-linked PE	P501F, P502F	100 – 300	DBU, MF
HDPE (High pressure pipes)	P501F, P504F	100 – 500	DBU
Wire and Cables			
Cross-linked PE	P501F, P502F	100 – 300	DBU
Blow Moulding			
HDPE, PP	P501F	100 – 500	DBU

MF: Melt fracture elimination **DBU: Die build-up**

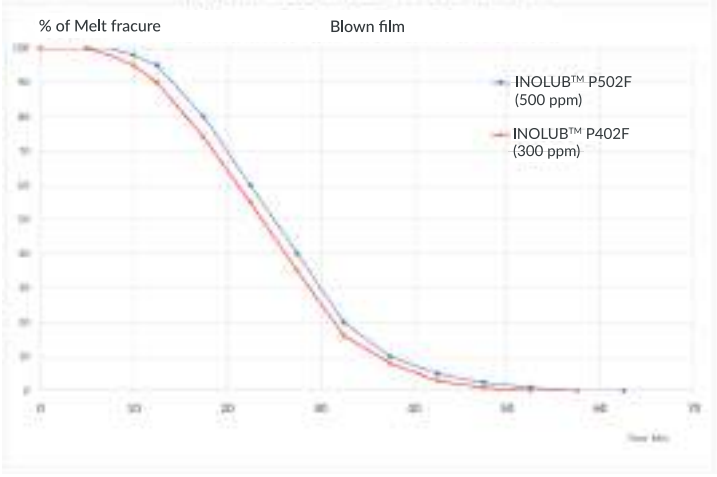
Conditions of use

INOLUB™ PPA is typically used at 50 - 1500 ppm to overcome processing issues encountered predominantly with polyolefins. For such low concentrations, it is highly recommended to use masterbatch (aka concentrate) for uniform dosing and optimum dispersion of the fluoropolymer particles. A typical masterbatch contains 1 to 5% of INOLUB™ PPA.

INOLUB™ PPA is also used in the preparation of commercial polymer compounds.



Pressure Reduction



Melt Fracture Elimination

RESEARCH & **DEVELOPMENT**

GFRC

Gujarat Fluoropolymers Research Center (GFRC) located at Dahej, India, is at the forefront of product & application development activities and serves as an essential bridge between market requirements and manufacturing operations. It focuses on offering genuine expertise and prompt customer support on INOLUB™ products.

GFRC, a team of research scientists & product specialists, is equipped with state-of-the-art application development laboratory including DCS operated pilot reactors. It has collaborated with renowned research institutes globally to work on the areas of new product development & sustainable manufacturing technologies. With this, the center focuses on delivering customized fluoropolymer products for novel applications and on developing manufacturing technologies which have minimal impact on the environment, thereby ensuring a sustainable future for the next generation.

Core functions of GFRC

Technical service	Product development Functional testing
Records and citations	Process optimization certifications and regulatory compliances
Pre-sales documentation	Analytical support statistical analysis and control
Development of processing guidelines	Customer on-site audits
Application development	Customer feedback analysis
Product literature	

GFRC has made dedicated tools available for INOLUB™ PPA customers. Using GFRC facilities, our customers will receive a performance report for their Masterbatch or PE resins processing behaviour.

Equipment	Processing Additives Testing
Twin screw compounding extruder	Preparation of Masterbatch or formulated polyethylene resins
Parr bomb	Fluorine content to determine dosage level of active ingredients in Masterbatch or Polyethylene resin
Hot stage optical microscopy	Dispersion of PPA in Masterbatch, Polyethylene resins or films
DSC, FTIR, TGA	Composition analysis of masterbatch or polyethylene resins
Capillary Rheometer	Pressure reduction time to make the Fluoropolymer coating of the die and die build-up
Blown film extrusion	Time to eliminate the melt fracture, optical properties on films (gloss & haze) and gel levels

Regulatory Compliance

GFL is committed to "Green Chemistry" and offers environment-friendly products using sustainable technologies. Our extensive research and development in the field of fluoropolymers enable us to comply with all major global regulations and facilitate our customers to choose greener products manufactured by sustainable technologies.

REACH - Registration, Evaluation, Authorization and Restriction of Chemicals

WRAS - Water Regulation Advisory Scheme

EC 1935/2004 - European Commission

EC 10/2011 - European Commission

ROHS - Restriction of Hazardous Substances

FDA - Food and Drug Administration

USP Class VI - United States Pharmacopeia

3A - Sanitary standards for design and fabrication of equipment

SVHC - Substances of Very High Concern

Sustainability

GFL is committed to social, environmental and economic sustainability through responsible processes, practices and greener initiatives not only in our products but also in our principles. While consistent operating results and strong financial performance are a business imperative, pursuing success while keeping Health and Safety paramount, remains one of our enduring values. The Company measures the impact of its business operations through the 3 key pillars of sustainability, namely People, Planet & Profit.

SA 8000:2014	ISO 37001:2016	ISO/IEC 27001:2013	ISO 26000:2010	ISO 20400:2017
Social Accountability System	Anti-Bribery and Anti-Corruption Management System	Information Management Security System	Social Responsibility Management System	Sustainable Procurement System

Disclaimers for warranty and liability exclusions

1. Save and except where a claim arises as a result of a manufacturing defect in the Product, the purchaser shall be responsible for all claims raised by end customers in relation to the Product relating to end-use or application including but not limited to, as a result of, delay of any order by the purchaser, inaccurate details of availability of Products displayed on the purchaser's website, lags or issues in the purchaser's end use or application, or any other negligence or default on the part of the purchaser or any of its authorized purchasers, affiliates, distributors, and their respective directors, officers, employees, agents, customers, successors and assigns.

2. This Product has been designed as per the certificate of analysis. Neither GFL nor any of its affiliates, distributors, and their respective directors, officers, employees, agents, customers, successors, and assigns assumes any responsibility for the end-use or application of any products including but not limited to those which do not conform with the specifications mentioned herein; any combination claims or modifications whatsoever.

3. GFL expressly acknowledges and agrees that it shall not be liable for any damages, or any other loss, whether direct, indirect, consequential, incidental, or special, suffered by the purchaser or any other third party, arising from any defect, error, fault, or failure to perform with respect to the specifications mentioned herein, even if the purchaser or third party has been advised of the possibility of such defect, error, fault, or failure.

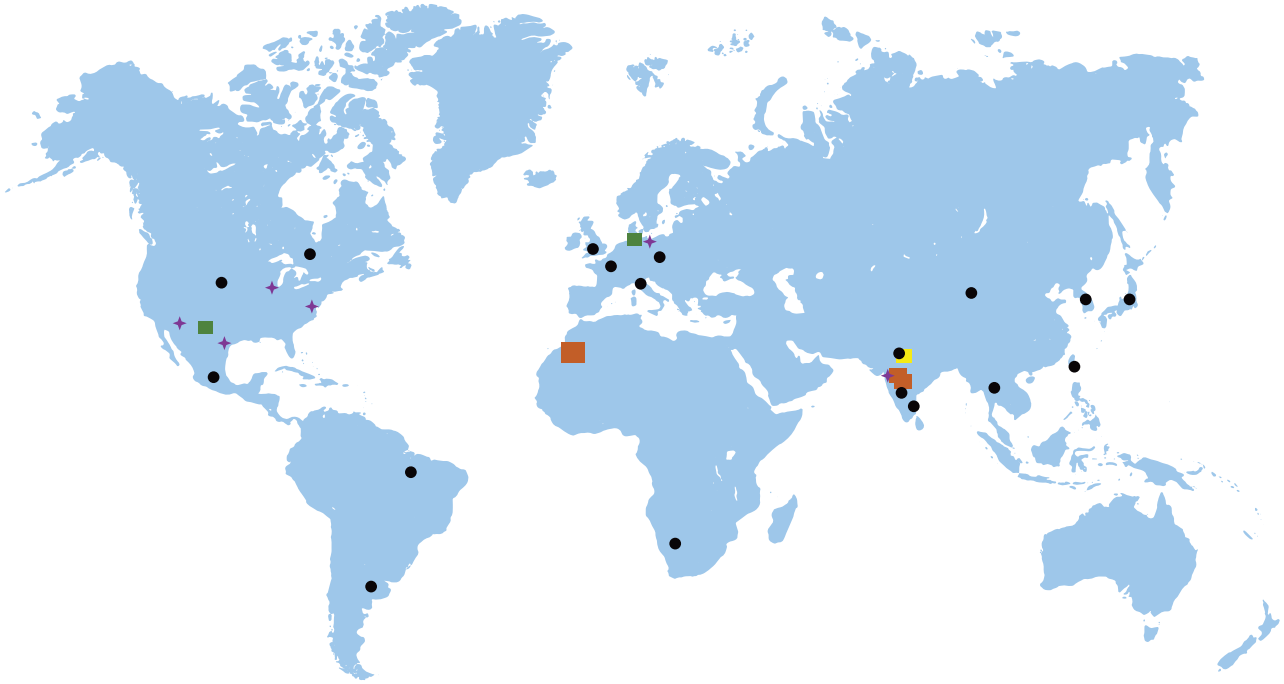
4. It is the sole responsibility of the purchaser to evaluate the Product for meeting its end-use requirements. The purchaser acknowledges that they have undertaken their own due diligence with respect to the application of the Product.

5. It is the sole responsibility and liability of the purchaser to determine the suitability of the Products supplied in order to ensure that the final product is safe for any desired end-use and its performance is as intended, in compliance with all applicable legal and regulatory requirements.

6. The purchaser is responsible for inspection and testing of the Products in order to satisfy itself as to the suitability of the Products for the purchaser's particular purpose. The purchaser is responsible for the appropriate, safe, legal use, processing, and handling of the Products.

7. GFL accepts no liability in respect of use of the Products in conjunction with other materials. The certificate of analysis and the specifications relate exclusively to the Products when used independently and not in conjunction with any other goods or materials.

8. GFL disclaims and provides no warranties or representations as to the merchantability or fitness of the Product for a particular purpose, end use, application, or the results obtained thereof. The purchaser agrees that neither party nor their affiliates shall provide any warranty on behalf of GFL, to any entity in relation to the Product



Corporate HQ
Noida, India

Warehouses
Texas, USA
New Jersey, USA
Arizona, USA
Indiana, USA
Hamburg, Germany
Gujarat, India

Subsidiary
Hamburg, Germany
Texas, USA

Manufacturing
Dahej, Gujarat, India
RN, Gujarat, India
Morocco, South Africa

Sales & Distribution
Americas: Michigan, Philadelphia, Atlanta, New Jersey, Mexico, Brazil, Argentina
Europe: UK, Belgium, Italy, Germany
ROW: South Africa, Thailand, China, South Korea, Taiwan, India, Japan

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GUJARAT FLUOROCHEMICALS
VALUE THROUGH GREEN CHEMISTRY

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