

Advanced-Engineered Thermoplastics

Innovative Technology for Challenging Environments



OVERVIEW

As a world-class leader in designing and manufacturing products made with advanced-engineered thermoplastic materials, we leverage our expertise from the markets we serve and the products we develop to give customers reliable, innovative solutions to their performance challenges. Greene, Tweed provides local technical expertise with a global reach, and our customers benefit from the

skill and knowledge of these highly trained local experts. With fully qualified engineering personnel in our offices throughout the Americas, Europe and Asia, we deliver the optimal solution to individual customer challenges.

HISTORY OF GREENE, TWEED PLASTICS

At Greene, Tweed we have expertise in the full spectrum of thermoplastic material technology coupled with an understanding of each material's attributes and benefits. We provide value-added thermoplastic material design, application development and manufacturing solutions for critical service applications.

From our initial use of thermoplastics nearly 30 years ago, we have differentiated ourselves in our markets through unique technological solutions. Beginning with the use of high-performance polymers to enhance our aircraft landing gear and flight control applications, our thermoplastic product solutions—many using our proprietary Arlon®

and Avalon® materials—have expanded beyond critical seal and bearings applications to include a wide variety of custom-engineered components. Today Greene, Tweed's engineered thermoplastic components are utilized in critical service applications ranging from electrical connector systems in downhole tools used for oil and gas exploration to containment rings and manifolds used in etch and chemical vapor deposition chambers for semiconductor wafer processing. Our ongoing investment in materials and process technologies ensures that Greene, Tweed will continue to provide innovative solutions for our customers.

MARKETS WE SERVE

Semiconductor & Solar: Our broad line of plastic materials provide minimal extractable ion content, plasma resistance, low particle generation and high-dimensional stability, making our thermoplastics well suited for wafer-processing chamber components and wafer-handling applications. Greene, Tweed advanced-engineered thermoplastics reduce system downtime and lower the cost of ownership.

Aerospace: Reduction in weight is critical in the aerospace market. Our advanced-engineered thermoplastics are not only lighter in weight than metal, but they provide a range of advantages, from corrosion and chemical resistance to wear resistance and nongalling behavior without the use of lubricants.

PetroChem & Power: Tough, high-temperature, semi-crystalline thermoplastics offer an excellent combination of mechanical, thermal, chemical and wear resistance for the hydrocarbon processing, chemical and power generation industries. Greene, Tweed's advanced-engineered thermoplastics are ideal for a wide range of aggressive environments commonly found in these applications.

Oilfield: The oilfield industry requires parts that can withstand extreme environments. Our thermoplastic portfolio contains materials that deliver excellent strength and chemical resistance at extreme operating temperatures.

Medical: Our material formulations deliver the wear resistance, corrosion resistance, dimensional stability and ability to be repeatedly sterilized using autoclave and gamma irradiation sterilization techniques.

ADVANCED-ENGINEERED THERMOPLASTICS EXPERTISE

Design and Manufacturing Capabilities

Building on our materials knowledge and our component design and manufacturing expertise, Greene, Tweed helps customers achieve the optimal solution for their application. When developing a solution, we consider factors such as design for manufacturing and assembly, performance requirements, life expectancy and cost of ownership. To facilitate the development of new thermoplastic components we provide a variety of engineering services including FEA, 3D prototyping, and mold-filling simulation and analysis. These services act as an extension of the customer's product-development resources, improve the efficiency of the product-development process and reduce product-development cycle time.

Molding Methods

With a variety of molding methods to best suit the application's requirements, we have the tooling and processing expertise to support your part design, tolerancing, lot size and economic requirements. Molding services include:

Thermoplastic Injection Molding—Our injection-molding capabilities offer the potential for a wide range of shapes and sizes.

Thermoplastic Compression Molding—Compression molding allows for the molding of larger, less complex parts that typically require machining or further fabrication.

Isostatic Molding—Isostatic molding is used for the molding of larger, less complex parts that typically require machining or further fabrication and provides superior material integrity and uniform properties. The size and flexibility of our presses and tooling enable us to produce a wide variety of rod and tube wall thicknesses and lengths.

Machining: CNC Fabrication Methods

All of our global facilities have CNC machining, including 5-axis milling, turning, grinding and boring. This capability guarantees consistent and accurate parts worldwide for all of our customers.

Specialty Manufacturing

In addition to our CNC fabrication capabilities, Greene, Tweed offers a range of other specialty manufacturing capabilities that enable us to produce customized components. These capabilities include waterjet cutting, ultrasonic welding and lapping.

In-House Testing

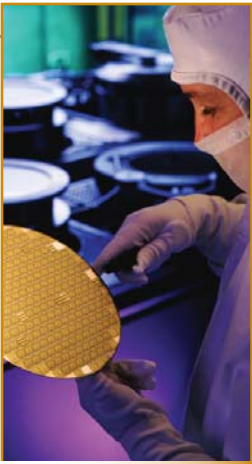
Greene, Tweed provides customers with exceptional front-end test and development support and ensures performance integrity at the end of the product-development cycle so customers are guaranteed reliable, effective plastic components. Our testing capabilities allow us to fully characterize a material so we can design parts to meet in-use performance requirements and better understand how the material will process in molding and machining.

Materials Testing Lab—Advanced equipment to evaluate basic properties of raw material for quality control, process development, optimization and failure analysis and to support proprietary material development.

Test Stands for Functional Testing:

- Electrical insulation testing
- Pressure and force testing
- Semiconductor-based plasma testing
- Pump leak and wear testing
- Wear, friction and PV (pressure velocity) testing





Semiconductor & Solar



Deposition

- Avalon® shield for BSV doors

Etch

- Avalon shield for BSV doors
- Focus rings
- Mechanical fasteners

Wafer Surface Preparation

- Spinner chucks
- Fluid handling connectors

CMP

- Arlon® or PPS retainer rings

Ion Implantation

- Wafer end effectors & bumpers
- Wafer guides & clips



Aerospace



Landing Gear

- Seal carriers
- Floating pistons
- Bearings

Flight Controls

- Ball screw scrapers
- Electronic housings
- Connector housings

Engine Components

- Sensor housings
- Conduit brackets & clips

Environmental Control Systems

- Valve bodies
- Blower housings



PetroChem & Power



Pumps

- Bearings & bushings
- Wear rings & sleeves
- MSE® seals
- Back-up rings

Valves

- Vee rings
- Ball valve seats

Compressors

- Valve poppets
- MSE seals
- Labyrinth seals
- Valve plates
- Rings & packings



Oilfield



Measurement While Drilling/Directional Drilling/Completion Equipment/Logging While Drilling

- Electrical connectors
- Encapsulated electrical components
- Back-up rings
- Seal stacks
- MSE seals

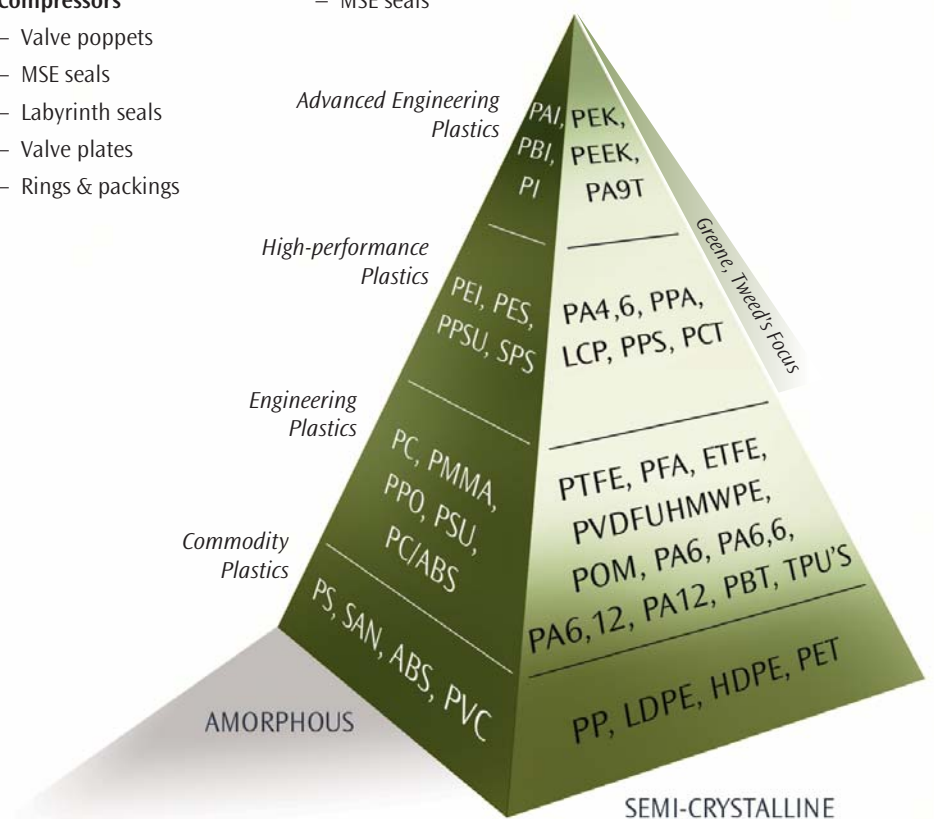


Medical



Medical Equipment

- Avalon scroll seals
- Avalon cup seals



MATERIALS AT A GLANCE

Arlon®

Our Arlon materials are proprietary polyketone thermoplastic compounds. Arlon is ideally suited for use in harsh or extreme environments requiring a durable, lightweight alternative to metals or other engineered materials. The operating temperature range of Arlon is broader than most plastics and extends from cryogenic to 480°F (250°C). Arlon offers excellent thermal stability, low wear and high-impact resistance in its unfilled form.



Avalon®

We offer a range of unfilled and compounded Avalon fluoropolymers. These materials provide excellent lubricity and low friction while fillers and reinforcements improve the elevated temperature performance and wear, abrasion and PV characteristics.



Other Engineered Materials

In addition to our branded compounds, Greene, Tweed's materials expertise includes a range of other high-performance amorphous and semi-crystalline thermoplastic materials including PI, PEI, PPS, LCP, PPSU and PES.



To learn more about what the Inside Advantage
can offer you, visit us at www.gtweed.com

Contact Us

Greene, Tweed Companies

Corporate Headquarters
Aerospace, Medical and
Semiconductor
Kulpsville, PA, USA
Tel: +1.215.256.9521
Fax: +1.215.256.0189

PetroChem & Power
Houston, TX, USA
Tel: +1.281.821.2094
Tel: +1.800.820.9005
Fax: +1.281.821.2696

Oilfield
Houston, TX, USA
Tel: +1.281.765.4500
Tel: +1.800.927.3301
Fax: +1.281.765.4553

Semiconductor
Santa Clara, CA, USA
Tel: +1.408.492.1155
Tel: +1.800.716.5316
Fax: +1.408.492.0050

Greene, Tweed & Co., Limited
Ruddington, Nottinghamshire, England
Tel: +44 (0) 115.9315.777
Fax: +44 (0) 115.9315.888

Greene, Tweed & Co France SAS
Cergy-Pontoise, Cedex, France
Tel: +33 (0) 1.30.73.54.44
Fax: +33 (0) 1.30.73.45.75

Greene, Tweed & Co. GmbH
Hofheim am Taunus, Germany
Tel: +49 (0) 6192.929950
Fax: +49 (0) 6192.900316

Greene, Tweed & Co. Italia S.r.l.
Milan, Italy
Tel: +39 (0) 2.21.05.17.1
Fax: +39 (0) 2.21.05.17.30

Greene, Tweed & Co. Japan
Tokyo, Japan
Tel: +81 (0) 3.3454.3501
Fax: +81 (0) 3.3454.1040

Greene, Tweed & Co., Korea Ltd.
Seoul, Korea
Tel: +82 (0) 2.566.5244
Fax: +82 (0) 2.566.5288

Greene, Tweed & Co., Benelux B.V.
Halsteren, Netherlands
Tel: +31 (0) 164.612.123
Fax: +31 (0) 164.610.030

Greene, Tweed & Co. Pte Ltd
Singapore
Tel: +65.6555.4828
Fax: +65.6555.5393

Greene, Tweed & Co. Pte Ltd
Hsinchu, Taiwan ROC
Tel: +886.3.656.8585
Fax: +886.3.565.0365


www.gtweed.com

Statements and recommendations in this publication are based on our experience and knowledge of typical applications of this product and shall not constitute a guarantee of performance nor modify or alter our standard warranty applicable to such products.

*All trademarks are property of their respective owners.
Greene, Tweed is an Equal Opportunity Employer © 2008, Greene, Tweed*



12/08-UO-2M BR-US-GE-020

 Printed on Recycled Paper