



# Putting science to work

HIGH PERFORMANCE MATERIALS

OIL AND GAS INDUSTRY



*The miracles of science™*

## HIGH PERFORMANCE MATERIALS

Working in the oil and gas industry – upstream as well as downstream and the oil sands can be environmentally and operationally challenging. DuPont recognizes the needs for highly specialized products and services. Whether you are looking for stimulation additives lubricants, surface tension reduction or bacterial control, let DuPont work with you to understand your application, operational needs, critical issues, and your definition of success.



## DuPont™ Krytox® Extreme Conditions. Extreme Performance.

Krytox® oils and greases provide exceptional solutions to your most difficult problems, from the aggressive world of chemical processing, to the high temperatures in state-of-the-art automotive, paper corrugating, and textile applications, to the critical tolerances of aerospace military specifications. Krytox® oils and greases offer a combination of properties that can extend the life of components, allowing manufacturers to extend warranties and manufacturing plants to reduce costly maintenance and downtime due to component failure. This is especially true in downhole operations, where the most severe service demands on your equipment can occur.



### Downhole Challenges

- High safety risk as well as accelerated corrosion due to presence of oxygen.
- High corrosion/erosion of bearings, pumps, cylinders due to steam, water, gasses.
- Downhole operations routinely run above temperature limits of mineral or semi-synthetic lubes.
- Presence of chemicals and corrosion inhibition agents.
- Costly downtime due to premature pump, bearing, or component failures.
- High abrasive and fretting wear degrades metal surfaces.

### Krytox® High Performance Lubricants Features

- Oxygen safe, non-flammable.
- Stable in water, steam, molten or aqueous caustics, acids and oxidizers.
- Can handle temperatures in excess of 360°C/600°F.
- Impervious to most corrosive chemicals.
- Assurance of protecting your operations and capital investment.
- Dramatically reduce operational downtime – maximize production.
- High film thickness and advanced anti-corrosion additives provide superior protection.



## DuPont™ Kapton® Polyimide High Performance Electrical Insulation Film

DuPont™ High Performance Films manufactures and supplies DuPont™ Kapton® polyimide film worldwide.

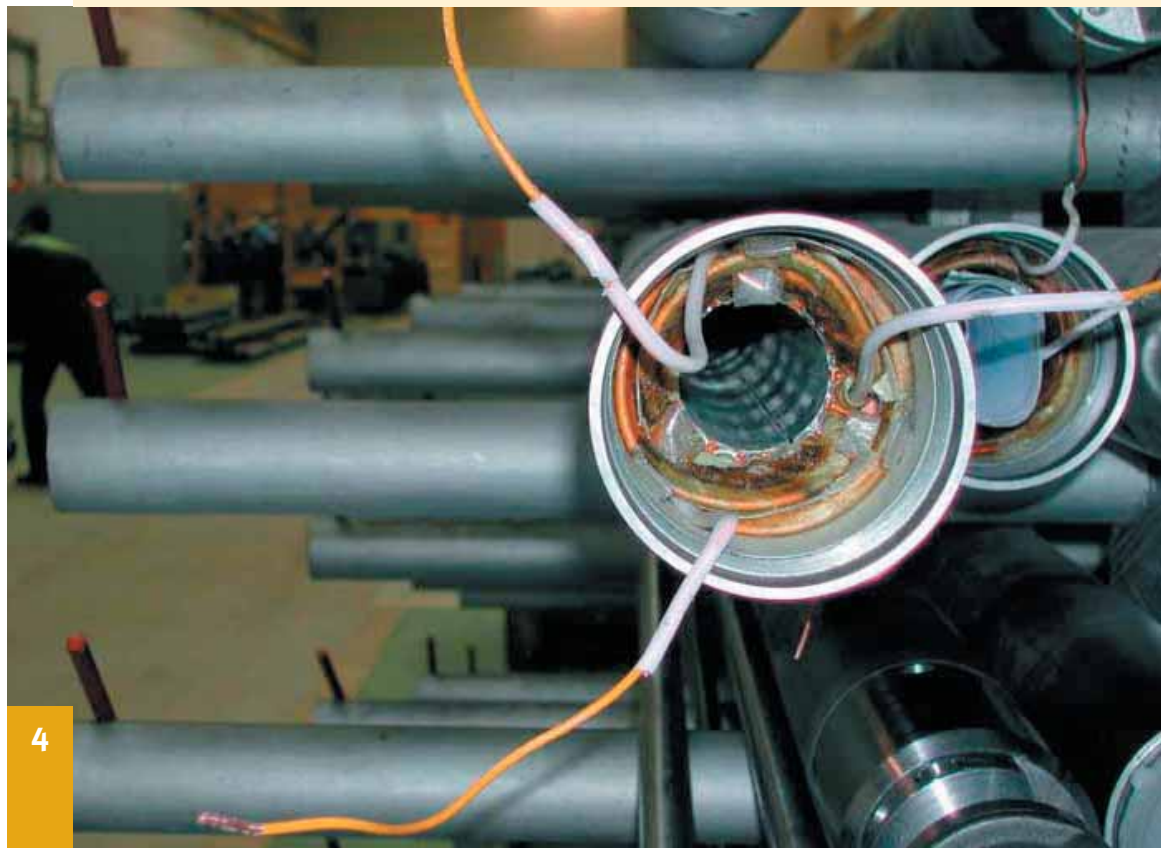
Kapton® polyimide film is widely used as magnet wire and slot insulation for electric submersible pump (ESP) motors and for insulation in pump motor leads.

For more than 40 years it has been the insulation of choice in the most critical electrical and electronic applications at temperature extremes from – 269°C to 400°C. Traditional demanding applications have included magnet wire insulation for locomotive traction motors, in transformers, and in wire and cable for aircraft.

### APPLICATIONS:

#### Insulation in Electric Submersible Pumps (ESP) units for artificial lift

- Motor Magnet Wire Insulation – thin heat-sealable Kapton® FN or FWN. Provides high & low temperature resistance, high dielectric and mechanical strength and resistance to aggressive environments.
- Motor Slot Liners – High temperature Kapton® HN and Kapton® FN.
- Motor Lead Cables – High temperature heat-sealable Kapton® FN or FWN as the first layer of the conductor insulation.





## Insulation in transformers of Gas-Turbine Stations (GTS) to produce electrical and heat energy

- High Voltage Coil Winding Insulation – heat-sealable thin Kapton® FCR. Exhibits high temperature and corona discharge resistance with excellent voltage durability at high temperatures.
- Low Voltage Coil Winding Insulation – heat-sealable and high temperature resistant thin Kapton® FWN.

## NEW PRODUCTS IN DEVELOPMENT:

### Kapton® 150PRN411

- Ideal for very high temperature magnet wire and motor lead insulation applications such as for Steam Assisted Gravity Drainage (SAGD) where improved layer-to-layer adhesion, abrasion resistance is required.
- Three layer polyimide-fluoropolymer composite heat fusible film.
- Unique balance of excellent electrical, mechanical, thermal durability and chemical resistance properties.

### Kapton® 150PRCR411

- Similar to Kapton® 150PRN411 with the additional advantage of providing excellent resistance to electrical partial discharge resistance with improved thermal conductivity.

### Kapton® EKJ

- Provides the highest resistance to extreme temperatures.
- Leading-edge all-polyimide technology. Adhesive consists of high temperature thermoplastic adhesive for the ultimate in thermal resistance.



## DuPont™ Hytel® Flexible Thermoplastic Solutions

Hytel® Thermoplastic Polyester Elastomers offers new solutions for many parts and components in the oil and gas and processing industries. They give the flexibility of rubbers, the performance of engineering polymers and the processability of thermoplastics. In particular, they have excellent resistance to a wide range of chemicals, oils, greases and other hydrocarbons, even at elevated temperatures. Hytel® can be moulded into complex shapes and dimensional tolerances beyond that which can be achieved with conventional elastomers. Hytel® is ideal for parts which require excellent flex fatigue resistance and stability of performance over a wide temperature range. Hytel® resin is available in a wide range of grades for different applications, from 30 shore D to 82 shore D hardness. Special grades are available with improved hydrolytic stability and lower permeability. Additives are available to further improve factors such as hydrolytic stability, heat stability, UV resistance, and reduction of friction and wear.



## DuPont™ Viton® Fluoroelastomers for Sealing at High Temperatures and in Harsh Chemical Environments

Viton® has been used in the oil and gas exploration, production, refining and upgrading industries for over 30 years to solve critical sealing problems where elastomers such as nitrile rubber or EPDM fail to provide adequate sealing performance. Applications include o-rings, gaskets, v-rings, radial lip seals, packer elements, bladders, diaphragms, pump stators, expansion joints and other custom shapes.

**Viton® will help extend the life of equipment, cut unscheduled downtime, and comply with tougher environmental regulations through increased high temperature capability and the ability to withstand aggressive fluids.**

The Viton® family of polymers includes a range of products designed to meet the varying needs of the oil and gas industry including:

- **Viton® AHV** – high hardness high modulus polymer designed to withstand high temperatures and pressures in hydrocarbon service.
- **Viton® B** – standard terpolymer designed to provide outstanding resistance to hydrocarbons and improved fluid resistance compared to Viton® AHV.
- **Viton® GF-600S** – peroxide-curable polymer designed to provide outstanding service in hydrocarbons, steam, hot water and methanol.
- **Viton® GLT-600S** – peroxide-curable polymer designed for outstanding low temperature sealing down to -40°C, with good resistance to hydrocarbons, steam and hot water.
- **Viton® GFLT-600S** – peroxide-curable polymer designed to combine the outstanding chemical resistance of Viton® GF-600S with improved low temperature sealing.
- **Viton® ETP-600S** – peroxide-curable polymer with the broadest chemical resistance in the Viton® family – suitable for service in harsh chemicals such as amines, formates, and high pH fluids.



## DuPont™ Viton® Fluoroelastomers for Sealing at High Temperatures and in Harsh Chemical Environments



All of the Viton® fluoroelastomer types provide continuous service up to 200°C and rapid gas decompression resistant compounds have been developed and used in the oil and gas industry based on these types.

DuPont Performance Elastomers has developed a network of partners in the Genuine Viton® program, which was designed to assure confidence to end users of elastomer products regarding the integrity of fluoroelastomer seals they purchase.

Genuine Viton® compounders, molders and part distributors offer products which are made with 100% virgin Viton® fluoroelastomer. Specify and ask for Viton® fluoroelastomers to ensure seal integrity. Look for the Genuine Viton® mark to assure that your supplier is working with Genuine Viton® partners.

### Sealing Applications in Oil Tools

- Progression cavity pumps
- Mud motors
- Packer elements
- Gate valves
- Perforating guns
- Blowout preventers
- Artificial lift pumps
- Safety valves

### Applications in Refining and Upgrading Plants

- Pumps
- Check valves
- Gate valves
- Ball valves
- Clamp Gaskets





## DuPont™ Kalrez®

### Perfluoroelastomer Parts for Best-In-Class Sealing in High Temperature High Pressure and the Harshes Chemical Environments

Kalrez® perfluoroelastomer parts have been specifically designed to deliver outstanding chemical resistance and thermal stability in aggressive environments and process conditions, ranging from chemical processing to oil and gas applications.

Kalrez® perfluoroelastomer parts have virtually universal chemical resistance. They withstand attack from more than 1,800 chemicals solvents and plasmas. Even after long-term exposure to temperatures up to 327°C (620°F), Kalrez® parts retain their elasticity and recovery properties better than other mid-to-high performance elastomers.

Kalrez® parts for oil and gas applications are available as v-rings, o-rings and custom shapes. They offer excellent explosive decompression resistance, extrusion resistance in high-pressure applications and excellent chemical resistance to drilling muds, sour gas, amines, cesium-potassium formates and high pH fluids.

Kalrez® will help reduce maintenance costs by extending mean time between repairs (MTBR), increase productivity with increased process up-time, improve safety by reducing the risk of seal failure, and reduce fugitive emissions for improved compliance with environmental regulations.

Kalrez® perfluoroelastomer parts encompass a range of products designed to meet the varying needs of the oil and gas industry including:

- **Kalrez® 3065** – long lasting choice for packer v-ring applications that is fabric-reinforced with aramid fibers, designed to function without extrusion under extreme pressures. Proven downhole performance with case histories of 30+ years service.
- **Kalrez® 3018** – high hardness choice for o-ring and custom shape applications when broad chemical resistance (including amines) is required.
- **Kalrez® 7090** – high hardness choice for o-ring applications where excellent mechanical properties are required including compression set resistance, seal force retention. Rated for service up to 325°C in acids, bases, carbon dioxide and hydrogen sulfide.
- **Kalrez® 6375** – designed to provide outstanding performance in the widest possible range of chemicals up to 275°C for parts used in chemical/hydrocarbon processing.
- **Kalrez® 1050LF** – designed for good hot water/steam resistance, excellent amine resistance and good compression set properties in medium pressure applications.



## DuPont™ Kalrez® Perfluoroelastomer Parts for Best-In-Class Sealing in High Temperature High Pressure and the Harshest Chemical Environments

In addition, Zalak® High Performance parts are also available from DuPont Performance Elastomers, which provide a base resistant sealing option based on a proprietary fluoroelastomer with excellent rapid gas decompression properties.

Please consult a Kalrez® Application Engineer or Authorized Distributor in your area for specific product recommendations in your application.

### Sealing Applications in Oil Tools

- Packer elements
- Electrical Submersible Pumps for Steam assisted gravity drainage (SAGD)
- Subsurface safety valves
- Logging boots
- Kalrez® Valve Stem Packing Systems
- Casing tie-back seals
- Survey tool seals
- Slip-joint seals

### Applications in Refining and Upgrading Plants

- Mechanical Seals
- Pumps
- Valves
- Clamp Gaskets

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## DuPont™ Teflon® and DuPont™ Tefzel® Fluoropolymer Solutions

Industrial products made with Teflon® fluoropolymer resins have exceptional resistance to high temperatures, chemical reaction, corrosion, and stress-cracking. The properties of Teflon® make it the preferred plastic for a host of industrial applications.

**Outstanding properties offered by our fluoropolymers product ranges known as Teflon® PTFE, Teflon® FEP, Teflon® PFA and Tefzel® ETFE:**

### **Nonstick**

Very few solid substances will permanently adhere to Teflon® surfaces. Although tacky materials may show some adhesion, almost all substances release easily.

### **Low Coefficient of Friction**

The coefficient of friction of Teflon® is generally in the range of 0.05 to 0.20, depending on the load, sliding speed, and particular Teflon® coating used.

### **Nonwetting**

Since surfaces coated with Teflon® are both oleophobic and hydrophobic, they are not readily wetted. Cleanup is easier and more thorough - in many cases, surfaces are self-cleaning.

### **Heat Resistance**

Tefzel® and Teflon® industrial coatings and polymers can operate continuously at temperature from respectively 155°C to 260°C.

### **Unique Electrical Properties**

Over a wide range of frequencies, Teflon® has high dielectric strength, low dissipation factor, and very high surface resistivity. By special techniques, it can be made electroconductive to be used as an anti-static polymer. Teflon® electrical coatings are widely used in ESP electrical motors, because of their high dielectric strength and temperature resistance. Downhole data logging cables as well as extension power cables are currently produced with fluoropolymers.

### **Cryogenic Stability**

Many Teflon® industrial coatings withstand severe temperature extremes without loss of physical properties. Teflon® industrial coatings may be used at temperatures as low as -270°C / -454°F.

### **Chemical Resistance**

Teflon® is normally unaffected by chemical environments.

Based on these properties, fluoropolymers bring solutions to the Oil & Gas Industry, but also to other highly demanding industries like CPI (Chemical Processing Industry), automotive, food, pharmaceutical, aerospace and appliance.



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