Oil & Gas

Contracting and Expanding

Orkot® bushings, frozen to shrink fit housings, are used on a production platform in the Gulf of Mexico.

Semicon

Smallest will soon be biggest

Nanotechnology will make electronic appliances smaller and potentially the quantum computer a reality.

Chemical & Processing

Keeping up with the grind

Sealing in coffee machines that can brew up to 300 cups of coffee per hour.
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Meeting emerging sealing needs of the oil & gas industry, chemical processing, food production and for semiconductor fabrication

Welcome to our sixth edition of *in the groove* focusing on sealing solutions in the oil and gas sector.

FlexiMold™, used to produce giant seals, is ideal for the offshore industry where equipment is on a large scale. One of their main uses is to energize Turcon® PTFE based seals. This is just one of our range of products we supply to the oil and gas sector. Find out more in ‘Working to the extreme’.

Our case story is about SBM Atlantia who provides turnkey engineering, design and construction of offshore production platforms. We detail a unique solution we provided for Neptune TLP, where Orkot® bushings were shrunk to fit into egg shaped housings.

Variseal® is an important product not only to oil and gas producers but also other sectors. Continually trying to meet emerging needs of these segments, a number of new profiles have been developed. We give an overview of these.

Our featured story for the food and beverage market is about seals supplied to WMF, the largest professional coffee machine maker in the world. The sealing solution for them was in Turcon® MF, specially formulated for hygienic applications. Like all new products and materials we develop, this went through our research and development process, the subject of our first story.

Semiconductor manufacturing is always at the leading edge, and this continues to be the case. Nanotechnology will allow chips and electronic devices to become even smaller and potentially make the quantum computer a reality. Why not read our article on this emerging technology.

Finally, as always, if you have any comments on our latest *in the groove*, email me at groove@trelleborg.com. We welcome your views.

Dr. Sandro Johannes Silverio
Global Director - CPI, Semicon, Oil & Gas segments
Upcoming Exhibitions

Katowice 2007

International Trade Fair for Mining, Power Generation and Metallurgy
11.9.2007 - 14.9.2007, Katowice, Poland

The International Trade Fair for Mining, Power Generation and Metallurgy in Katowice is the largest European exhibition presenting the latest achievements of this industry. Coming from all over the world, companies exhibiting represent the mining and metallurgical sectors and their suppliers.

49th International Engineering Fair - MSV 2007

1.10.2007 - 5.10.2007
Brno, Czech Republic

MSV 2007 is the largest technology trade fair in central Europe with over 2,000 exhibiting companies, including over 800 foreign exhibitors. MSV is a unique portal for news, innovations and key trends from all branches of the engineering industry.

i-SEDEX 2007

18.9.2007 - 20.9.2007
Seoul, Korea

i-Sedex is Korea’s largest international exhibition in the semiconductor and display area. It involves domestic and foreign device companies. It provides the platform for companies in this sector to show their products and exchange ideas.

International Technical Fair

Plovdiv, Bulgaria

The International Technical Fair exhibits the latest developments of world leaders in machine engineering, automobiles, transport, information technologies, software, electronics, electrical engineering, construction, chemistry, power engineering, ecology, etc.

SEMICON Taiwan 2007

Taipei, Taiwan, Hall 1, Stand 2738

SEMICON® Taiwan is the preferred event for the buyers in this region to see and compare semiconductor equipment and related products and services from all over the world. Besides being a leader in wafer fab processing, Taiwan is home to many leading semiconductor packaging and test companies.

To see all exhibits, visit Service/Fairs on our website:
www.tss.trelleborg.com
This year’s SEMICON West show took place from July 17th to July 19th in San Francisco, California. Trelleborg Sealing Solutions was represented by a global team from the United States, Germany, the UK, Korea and Taiwan.

SEMICON West is the largest and most comprehensive industry event in the United States, hosting more than 1,500 key players in the semiconductor, FPD, MEMS, display and microelectronics industries. The conference, held in San Francisco, California, showcases the latest products and technologies currently used in manufacturing while highlighting the technology of tomorrow.

Success at SEMICON West

“It was a great atmosphere,” says Mark Russell, Semiconductor Segment Manager for Trelleborg Sealing Solutions Americas. “We were in a super location in the South Hall, and we had an outstanding time interacting with potential customers and also with one another.

In addition to the show, there was also a global semiconductor group meeting among the Trelleborg team that took place on the 20th. With representatives from all over the world, the meeting was very effective. The team was able to work on a global semiconductor industry plan, as well as get insights into what goes on in other parts of the world.”

On show in bonny Scotland

September sees us once again at Offshore Europe. It’s held at the Aberdeen Exhibition and Conference Centre at Bridge of Don, Aberdeen from 4th to 7th September. We’re exhibiting with our other colleagues from within Trelleborg Group who are also involved in the oil and gas industry. We’ll have on show everything from glass microspheres to risers and from fenders to seals. Why not come and visit us on stand 1177.

Trelleborg Sealing Solutions
In the groove, No. 2, 2007
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Sustainability
on the web

The term sustainable development involves such areas as environmental issues, labor conditions, human rights, prevention of corruption and anti-competitive behavior. These are important issues for Trelleborg Group and to emphasize our focus on these, a new website area has been created. Here detailed information can be accessed on environment, social performance and socioeconomics.

To view the sustainability website go to

www.tss.trelleborg.com/sustainability

Customer support:
Where the action is!

Trelleborg Sealing Solutions opens an oil and gas customer support center in Aberdeen

We’re pleased to announce our new customer support center focusing on the needs of the oil and gas sector. It’s located in the Innovation Centre, Bridge of Don in Aberdeen, Scotland. Right in the middle of the area’s engineering activities, the new facility will provide technical support to our existing and developing customer base in the region.

“In the fast moving and challenging offshore environment new solutions are constantly demanded,” says Richard Everett, Director of Strategic Growth Projects, who had responsibility for founding the new office.

“With our vast experience and specialized skills, the customer support center will closely liaise with designers and engineers,” continues Richard. “It will act as a link between our manufacturing and R&D facilities, enabling us to rapidly deliver innovative solutions to meet specific requirements. Close location, right where the action is, means we can respond rapidly in short timescales, to maximize operator efficiency.”

For further details on the Trelleborg customer support center go to:

www.tss.trelleborg.com
US acquisitions expand capabilities in North America

Distributor AFM increases presence in US Northwest and central California

In July, Trelleborg Sealing Solutions acquired the privately owned US AFM Inc, a rapidly growing distributor of hydraulic seals and customized rubber components. With its head office in Portland, Oregon, and an office in Fresno, California, the company has about 45 employees and annual sales of approximately €9 M ($13 M, SEK 85 M).

“AFM is a profitable and well-managed company with a wide range of products. This acquisition increases our market presence in the US Northwest and central California,” says Claus Barsøe.

Precision seal manufacturer HCRD will aid growth

May 31 saw the acquisition of Hydro-Components Research & Development Corporation (HCRD). Employing approximately 80 people and with annual sales of about €5.4 M ($7.3 M, SEK 50 M) it is based in Streamwood, Illinois. Manufacturing high-precision components, it focuses specifically on large diameter seals and bearings.

“HCRD’s technology and products are at the leading edge of development in the company’s area of focus and will make an extremely valuable contribution to us,” says Claus Barsøe. “The products fit in ideally with our current portfolio, will expand our offering and enable us to grow more rapidly in North America.”
A material matter

Leading edge materials technology is fundamental to effective sealing

On the outside, one seal may appear to be the same as the other. But the technology behind their material means that one type can function very differently from another. Making sure the compounds meet industry needs means that seals can be matched to a specific application, optimizing performance.
Research & Development

Why are more sealing materials required?

○ For compatibility with new contact media
○ To comply with more stringent regulations
○ Provision of a solution to a customer’s specific problem
○ To withstand increased temperature in an application
○ For improvement in performance to extend seal life

Trelleborg Sealing Solutions has over 2,000 proprietary compounds to its name. That’s more than any other seal developer and manufacturer. Thousands of hours of research and unrivalled years of experience combine to make our sealing formulations successful.

“We invest a substantial amount of resources every year in development of new sealing materials,” says Nils Kohlhase, Director, Research and Development Europe. “Our laboratories for mixing and testing are situated globally. We gather ideas for development projects continuously through our Innovation Management Process. To do this we listen to our customers, segment experts, sales people and engineers.”

Continuous material evolution is important as the demands of different industries are constantly changing. Even though the range from Trelleborg Sealing Solutions may appear to fulfill all requirements, new variations are necessary to meet the latest challenges.

“There are many reasons why we need to add materials. Changing market requirements are always a key focus for us,” continues Kohlhase. “In the chemical processing sector we’re facing increasingly aggressive media at extreme temperatures. There are special issues too such as explosive decompression in oil & gas applications and sealing in vacuums and plasma in semiconductor processing. When we have new requirements it is possible that one of our existing compounds is suitable. If not, then priority is put on creating one that will be effective. This ensures we can continue to meet our customers’ needs as quickly as possible.”

Our global research and development centers are located in:

Europe
- Stuttgart
- Helsingor
- Ashchurch
- Bridgewater
- Malta

USA
- Fort Wayne

Asia
- Tokyo
- Shanghai
WORKING TO THE EXTREME
In oil and gas applications, seals and bearings need to operate at the extremes of their capabilities. Trelleborg Sealing Solutions provides a wide portfolio of products that meet the most demanding of needs.

Sealing solutions meet industry needs

Sealing materials and products offered for the oil and gas industry have:

- Temperature resistance from cryogenic up to +850°C / 1560 °F
- Almost universal chemical resistance; withstanding aggressive sour gas, corrosive fluids, hydrocarbons, carbon dioxide, acids, solvents and amine-based corrosion inhibitors
- Excellent thermal stability
- Steam and explosive decompression resistance
- Good mechanical strengths
- Low long-term compression set
- NORSOK approval
Isolast® Perfluoroelastomer: the ultimate in elastomer sealing

Isolast® is the Trelleborg Sealing Solutions range of premium perfluoroelastomers (FFKM). It presents the ultimate in elastomer sealing. Virtually inert and demonstrating almost universal chemical compatibility, it is ideal for hydrocarbon processing applications. Specialized grades can operate at continuous temperatures up to +325°C/+617°F, and specially formulated explosive decompression and steam resistant compounds are available. In addition, the resistance of Isolast® to amines extends the life of seals in contact with corrosion inhibitors, a known problem in environmentally friendly water-based drilling equipment.

Flexible product and material offerings in elastomers

A wide range of elastomer solutions is available. For static applications, any size of O-Ring (standard or custom) can be manufactured, even to giant dimensions, alongside custom molded designs and bonded products. These can be supplied in materials ranging from basic elastomer grades to leading edge, high specification compounds, particularly developed for the oil and gas industry. HNBR and FKM materials, including our high specification Resifluor®, are engineered to maximize effectiveness at high temperatures and when in contact with aggressive chemicals.

Inventive designs extend seal capabilities

A development of the standard O-Ring, FEP encapsulated O-Rings consist of a fluoroelastomer or silicone elastomer O-Ring housed within a seamless FEP jacket. They are ideal when a cost-effective solution is required that offers better chemical compatibility, equivalent elasticity to an O-Ring and the added benefit of improved friction characteristics. QUAD-RING®, manufactured from the same materials and to the same groove dimensions as standard O-Rings, can directly replace these when movements are found to cause twisting, reducing sealing integrity.

Variseal®: field-proven in extremes

An important product to the oil and gas industry, Variseal® spring-energized Turcon® PTFE seals are field-proven in extreme gas and liquid handling situations. They have been used in the most demanding of production and refining applications and are designed to fit in existing O-Ring grooves. With the correct selection of PTFE, filled PTFE compounds and appropriate spring material and profile, Variseal® can provide the highest level of system integrity. Suitable for use even in the most aggressive and corrosive of chemical media, they provide excellent explosive decompression resistance.
Turcon®: better wear and friction characteristics

A range of Turcon® PTFE based solutions offers advanced sealing for rotary applications. In Turcon® Glyd Ring®, Turcon® Roto Glyd Ring® and Turcon® AQ-Seal®, an elastomer O-Ring or QUAD-RING® energizes a PTFE sealing ring. Engineered to reduce friction with high wear and abrasion resistance, they are ideal for high-pressure situations. The Double Delta® fits in an existing O-Ring groove and expands the parameters of the O-Ring used with it, improving wear and friction characteristics.

Bearing solutions

Bearings manufactured from Turcite®, an engineered PTFE based thermoplastic, prevent metal to metal contact between piston and rods, bores and glands, absorbing transverse load and with low friction, minimize stick-slip. Bearings from Orkot®, a non-asbestos synthetic, composite material incorporating solid lubricants, provide exceptional wear resistance and virtually no swell in water. Ideal for subsea environments they offer effective and maintenance free solutions in seawater.

Wills Rings®: metal seals for high temperatures

Wills Rings® are the original metal seals, providing the optimum solution in static sealing on connectors, flanges and plates for gases and liquids. They operate effectively under extremes of temperature, ranging from cryogenic to 850°C /1560°F and severe pressures, often being utilized when fire safe sealing is required. Wills Rings® are available in a variety of metals, O or C cross sections with either pressure filled or system pressure activation.

See article on FlexiMold™ on page 14, our new technology for production of giant seals
In the oil and gas industry, the equipment used tends to be on a large scale. The typical diameter of a swivel stack and some of the connectors used can be two meters/six feet. The seals required for these are beyond the sizes available as standard molded components, and usually the volumes required can never justify production with a dedicated tool.

**Superior giant seals fabricated by the proprietary FlexiMold™ process**

The conventional method of producing large diameter O-Rings and seals is by splicing extruded cord. However, inherent in this method of fabrication is a weakness at the join, along with poor surface finish and difficulty in achieving tight tolerances.

FlexiMold™ is a superior solution; a proprietary technology specifically developed by Trelleborg Sealing Solutions for manufacturing of large O-Rings and other seal profiles. With this method, production of giant high quality seals is possible without the leadtime and cost associated with dedicated tooling. Importantly, the FlexiMold™ process eliminates the risks associated with spliced O-Rings, ensuring the full visual, dimensional and functional integrity of a molded seal.
Equipment in the oil and gas industry tends to be on a large scale. That means seals produced from the unique FlexiMold™ process are an ideal solution.

**FlexiMold™ is an excellent energizer**

An important use for large FlexiMold™ O-Rings in oil and gas applications is as an energizer for Turcon® seals such as Roto Glydring®, Vector or VL Seal™.

"Turcon® PTFE based seals are ideal for use in oil and gas applications," says Bill Allan, European Oil and Gas Segment Manager. "They withstand extreme temperatures and are resistant to virtually all media. As these seals are machined, they can be produced in large sizes up to three meters/ten feet in diameter.

"However, PTFE has no elasticity and needs to be energized. In Variseal®, this is done with a spring, but for closed grooves this design is not compact enough. For these an O-Ring energized seal is better. Up until now it has been difficult to source an O-Ring to do this with the required integrity, cost-effectively. The tool cost tended to make them too expensive for most customers."

**Turcon® PTFE and Isolast® seal combination provides the ultimate in media compatibility**

“The FlexiMold™ process now means we have the ideal energizer for our large Turcon® PTFE seals,” continues Bill. “FlexiMold™ O-Rings have the same integrity as a molded product but more importantly can be manufactured without the need for a dedicated tool. When O-Rings are fabricated in Isolast®, their combination with a Turcon® PTFE seal represents the ultimate in media compatibility, capable of operating in extremes of temperature in dynamic applications.”
Features and Benefits:
- Capable of producing any diameter above 500 mm/20 inches
- Full visual and dimensional product integrity
- High quality, tight tolerances
- Performance capabilities matching molded O-Rings
- Elimination of leakage risks associated with spliced O-Rings
- No tooling charges for standard cross sections
- Available in Isolast® perfluoroelastomer and a wide range of other elastomers

Materials:
- Isolast® perfluoroelastomer (FFKM)
- Resifluor™ High Performance Fluorinated Elastomers
- Fluorocarbon (FKM)
- Ethylene Propylene (EPDM)
- Acrylonitrile Butadiene Rubber (HNBR)
- FDA, USP Class IV approved compounds

Service:
- O-Rings supplied to standards ISO 3601-1, AS568 and JIS B 2401
- Product inspected to zero defect policy
- Parts packaged and labeled individually
- Washed and packed in Class 100 Cleanroom if required
- Express delivery service available

Product availability:
Sizes:
- Recommended for diameters > 500 mm / 20 inches

Cross Sections:
- All standard cross sections available without purchase of dedicated tool
- Larger and special size cross sections available upon request
- Non-standard seal profiles available upon request

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Oil and gas applications for FlexiMold™ seals

- Any large scale static sealing requirement
- Swivel stacks on Floating Production, Storage and Offloading (FPSO) vessels
- Pipeline corrosion monitoring equipment
- Connectors both offshore and onshore
- Heat exchangers
- Compressors
- Gas turbines
- As an O-Ring energizer for large machined Turcon® PTFE based seals
Trelleborg Sealing Solutions solves corrosion issues for SBM Atlantia on an offshore rig in the Gulf of Mexico. This involved innovative assembly technology where bushings are shrunk before installation in their housings, to give optimum fit.
SBM Atlantia, headquartered in Houston, Texas, provides turnkey engineering, design and construction of offshore production platforms around the world. For one of these large scale projects, the Neptune TLP (Tension Leg Platform) in the Gulf of Mexico, SBM Atlantia required eight new bushings to be designed and manufactured. They contacted Trelleborg Sealing Solutions Southwest for help.

Neptune TLP

The Neptune TLP (Tension Leg Platform) gets its name from the offshore field in which it is located. The Neptune Field is in the Gulf of Mexico, about 222 km/ 120 nautical miles off the coast of Louisiana in the southeastern United States. The Neptune TLP is the fifth SBM Atlantia SeaStar® TLP in the Gulf of Mexico. It is stationed in 1,311 meters / 4,300 ft of water, and has seven subsea wells which are connected to the facility. The Neptune TLP has the design capacity to produce up to 50,000 barrels of oil and 50 million cubic feet of gas per day.

Corroding of pull-in shoe housings in seawater was an issue for SBM Atlantia

The project called for eight bushings to be used in pull-in shoe housings and aid as pivots for installation of their SCR (Steel Catenary Riser) systems. The riser system is the vertical pipeline from the wellhead on the ocean floor to the production platform stationed at the waterline. A pull-in shoe is a large drum that is horizontally welded to the platform structure just above the riser hangers. A crane on the platform is then strung behind this and aids in directing the riser system as it is lifted into place. Traditionally the pull-in shoe housings were not fitted with bushings because of the weight but seawater was corroding these parts together, making them no longer usable.
Due to the massive weight of the risers, the bushings, with a diameter of 1,270 mm/ 50 inches, needed to be designed to allow the pull-in shoe to continue to rotate under extreme loads. Also, the pull-in shoe system is submerged in seawater and must remain operational for future use. The solution proposed by Trelleborg Sealing Solutions was for bushings in Orkot®, a proprietary advanced composite bearing material, which has exceptional resistance to seawater.

Installation of each bushing into their housing was a large concern. A particularly difficult aspect to this project was that the bushings had to be installed into egg-shaped metal drums supplied through a construction company contracted by SBM Atlantia. “It was a logistical nightmare for Atlantia,” says Eric Bucci, Oil & Gas Segment Manager for Trelleborg Sealing Solutions Americas. “We solved this for them by having the drums shipped to the Trelleborg Sealing Solutions facility in Eugene, Oregon and completing the insertions ourselves.”

On delivery to Eugene, due to the irregular shape and surface finish of the drums, they were re-machined to specification. But that was only half the battle. In order for the Orkot® bushings to fit properly, they had to be shrunk for insertion inside the drums. Trelleborg Sealing Solutions Eugene constructed a large chamber to freeze the bushings and submerged them in liquid nitrogen to shrink them to a smaller diameter. The Orkot® bushings were inserted successfully, and the assemblies were shipped back to Atlantia in a short time frame. “The superior service and quality delivered for the Neptune project has certainly positioned Trelleborg for extensive opportunities on future SBM Atlantia projects,” says Clay Thompson, Installation Manager, SBM Atlantia.
Orkot® TLMM

Products made from Orkot® composite materials have exceptional wear resistance and virtually no swell in water, providing dimensional stability. They offer tolerance to edge loading and misalignment even with the heaviest loads and are particularly suited to freeze fitting without the danger of shattering. Orkot® TLM Marine is the standard grade of material incorporating woven fabric reinforcement and solid lubricants within a thermosetting resin matrix. The material can be used in conjunction with water and grease lubrication and can be run dry for limited periods.
Keeping up with the grind

You can’t compare the professional coffee machines manufactured by WMF to those you’ll find in the average home. Their machines are engineered to brew up to 300 cups of coffee per hour. That means each component must be of the highest quality and durability. The same robustness is required from the seals that Trelleborg Sealing Solutions supplies for these appliances.

In WMF coffee machines, the standard non-abrasive plastic internal parts of domestic models are replaced with metal. Not only must seals be able to withstand movement against these harder counter surfaces, they must also stand up to heat, acid, pressure, cleaning media and abrasive coffee grounds.
The demands on seals in the WMF coffee machines are high. They need to have:

- **Excellent friction characteristics**
  For movement against the equipment’s metal counter surfaces

- **Exceptional wear resistance**
  To withstand abrasion from ground coffee beans

- **Compatibility with process media**
  Including acids in coffee, fats in milk and the aggressive chemicals in cleaning regimes

- **Capability to operate under pressure**
  Boiling water is forced through the coffee grounds at up to 16 bar / 232psi

- **Outstanding life**
  To stand up to brewing of at least 100,000 cups of coffee

To meet all these requirements a seal was specified in Turcon® MF, our proprietary PTFE based material specifically designed for food, beverage and pharmaceutical processing. A modified Stepseal® design was selected, engineered to endure this intensely dynamic environment.

**Turcon® MF designed for processing needs**

Based on ultra-clean technology, these compounds are manufactured from high-purity PTFE grades and additives. Their smooth finish, with high gloss and low porosity, avoids the risk of contamination buildup and reduces particle shedding. Each batch of MF material is manufactured using high-purity material only and can be issued with a certificate of conformity.

Our range of Turcon® based PTFE materials offers:

- Temperature resistance from −253°C / -423°F to +260°C /500°F
- Almost universal chemical compatibility
- Outstanding low long-term compression set characteristics
- High wear resistance
- Minimal creep and permeation
- Surface finish minimizes contamination risk
- Materials perform well in a broad range of chemical media including organic and inorganic oxides, acids, alkalis, amines, esters and steam
- Materials compliant to FDA 21 CFR177.1550, 3-A, USP Class VI and sanitary standards

**WMF... coffee wakes up the world**

From cappuccino to latte macchiato, WMF has technologically advanced machines to make them all. The world leader in manufacturing of professional coffee makers, their equipment is heavy duty and designed to meet caterers’ needs.

**Making the perfect cup of coffee... 300 times per hour**

In the WMF bistro range of machines, coffee is freshly ground. A piston presses these grounds into a cylinder, at the bottom of which is a metal sieve. To make the coffee, boiling water is jetted through the cylinder with a 70 mm /2.7 in stroke of the piston at a pressure of 16 bar /232psi. The sieve then swings down and the piston pushes the used coffee grounds out of the cylinder into a collecting tray. This process is repeated for every single cup of coffee, up to 300 times per hour.
Windows that clean themselves, material that is light as a feather and stronger than steel, an elevator into space... In the world of nanotechnology, fantasy and reality converge.
Through the relatively new nanotechnology, the future is already here. The possibility at atom level of mixing physics, chemistry and biology to produce new materials with customized properties opens the way for highly innovative products and applications in a number of areas.

Nanoscience has become perhaps the most prominent area in research and, in the long term, nanotechnology could become the hub of a new industrial revolution. But what is nanotechnology?

In the new, advanced nanolaboratory at the Lund Institute of Technology, Martin Magnusson serves as a link between research and the business sector at the interdisciplinary Nanometer Consortium.

“Nanotechnology is used to manufacture articles on the scale of 1–100 nanometers and to make use of these structures. Nanoscience is about the aspects that are specific to such small systems and what can be done with the help of nanotechnology,” he says. The central feature of nanoscience is that a material’s properties are changed at nano level.

For physicists, this phenomenon means that a new type of physics occurs; chemists can achieve more accurate measurements and create new structures; in biomedicine, it is possible to measure individual molecules; and materials scientists can create new materials.

“For example, gold has certain material properties. But if you take a single gold atom, it has none of these, except perhaps the density. At nano level, it is also possible to mix materials in a way that would be impossible if they were bigger. This facilitates the creation of new, exciting composite materials.”

There are already a number of products based on nanotechnology: car tires with superior wear properties, stainless textiles and ultra-thin surgical needles. The self-cleaning windows are also reality, but we will probably need to wait for NASA’s nanovision of using ultra-thin, extremely strong wires to take an elevator straight out into space – although it is already possible in theory.

“The area is usually divided according to application: electronics, medicine and material. We are
becoming increasingly effective at creating material with more controlled properties. They can become stronger, lighter, conduct heat better or less well... Whatever it is we want them to do,” says Martin Magnusson.

Using nanotechnology, a manufacturer has succeeded in producing a synthetic rubber that has improved heat resistance, elasticity and flexibility. With nano-size particles, it is even possible to reinforce silicon rubber so that it becomes both transparent and robust.

“One of the most exciting features is combination solutions that involve mixing active elements and sensors from biology and physics in materials science. There has been success in creating air-cleaning and self-washing concrete and work is being conducted on self-repairing plastics. By nano-structuring surfaces, attempts are also being made to make them self-sealing so that no packing is needed,” says Martin Magnusson.

Slowly but surely, researchers are developing nanotechnology, but the mass-production of nanostructures with sufficient precision remains the stuff of science fiction. The integral complexity of the technology means that costs become too high.

“It will be some time before it takes 18 months from the research lab to industry earning money on a solution. But there is plenty that can be done and companies have to tell us researchers what they need. There is nothing we want more than to cooperate with industry,” says Martin Magnusson.

Quantum leap

A key focus for the semiconductor industry is the quest to produce the quantum computer. Following the laws of quantum physics, the quantum computer would have enormous processing power through the ability to be in multiple states and to perform tasks using all possible permutations simultaneously. Nanotechnology is a key element to making this dream a reality.

The initial implementation of nanotechnology will help make chips that are smaller, faster and more powerful. It is estimated that by 2015 the spend on nanotechnology-based applications will be major in the semiconductor industry with investment in developments increasing year on year.
Nanotechnology in semiconductor equipment:

- The 90 nm node is already in production and the industry is working toward 63 nm.
- In lasers quantum wells are to be substituted with quantum dots produced from nanometer sized crystalline particles.
- Nanowire technology will allow the pushing of electrons into ever smaller spaces.
- Films are in development made of carbon nanotubes (CNTs) and nanoparticles to help make chips smaller and faster.
- Spintronic theory has led to nanoscale devices that increase read head sensitivity of a hard disk drive, significantly expanding storage capacity.
- Self assembly on hard disks is resulting in higher percentage particle alignment, giving greater magnetism and more storage in the same space.
- Nanoimprint lithography is moving from the 32 nm mode to 1 nm dimensions.

A millionth of a millimeter

Within nanotechnology, researchers work with individual atoms, making it possible to move atoms, create new materials and change the properties of existing materials. An atom is about 0.2 nanometers in diameter and you get one nanometer if you divide one millimeter a million times. One nanometer has the same size in relation to a tennis ball as the tennis ball has to the globe.

The name “nanotechnology” was first used in the 1970s. A breakthrough was achieved in 1981 with the invention of the scanning tunnel microscope, which meant that it was possible for the first time to see the surface of atoms and to actually touch individual atoms.

Sealing - the future - with nanotechnology

“As our customers’ equipment moves into the nano-dimension so will our sealing products,” says Elke Voehringer-Klein, European Semiconductor Segment Manager. “Certainly sealing in these microstructures will present new and possibly yet unknown challenges. We expect our sealing materials will have to embrace nanotechnology too.

“Research and development is increasingly being devoted to the development of the ultimate that can be accomplished from nanotechnology, the intelligent seal. In the meantime we are seeing, in response to demands from the semiconductor market, focus on material fillers based on nanotechnology principles. These organic compounds offer increased resistance to chlorinated and fluorinated gases, high temperatures and harsh process chemicals while lowering particulation.”
Variations on a theme

Turcon® Variseal® is a popular seal for use in processing systems. Always looking to maximize the applications for this product, Trelleborg Sealing Solutions has engineered new variations to meet specific market demands.
At the leading edge of sealing technology, Trelleborg Sealing Solutions introduced Turcon® Variseal®, the original PTFE based spring-energized seal, in the 1970s. Continually enhancing the product, advances have focused on materials, profiles and spring designs. Each variation is engineered to meet specific requirements within the marketplace and here we feature some of the latest developments.

Why Turcon® Variseal®?

Turcon® is a PTFE based material. This has major advantages in processing applications due to the fact that it is resistant to virtually all media. That includes the aggressive chemicals in CIP (Cleaning In Place) and SIP (Sterilization In Place) regimes along with gases and plasma in semiconductor equipment. It also withstands extreme temperatures, such as those seen in oil and gas production. With exceptional friction properties, it is ideal for dynamic applications, preventing sticking to counter surfaces, even after extensive periods of rest.

Turcon® Variseal®: development and manufacturing on two continents

Significant ongoing research and development is taking place with the Turcon® Variseal® product on both sides of the Atlantic. Within the UK, manufacturing of Turcon® Variseal® takes place at Trelleborg Sealing Solutions Bridgwater, while in the US it is produced at Trelleborg Sealing Solutions Broomfield. Product development is coordinated through extensive test facilities on both continents, the facilities working together to maximize the uses for Variseal®.
Meeting market needs

Turcon® Variseal® Ultra-Clean™

In this design, the spring required to activate the seal is fully enclosed in a Turcon® PTFE based case. This ensures that no bacteria can be caught in the dead space around the spring, important in food, beverage and pharmaceutical systems. It also prevents metal extractables entering semiconductor fabrication processes.

Features and Benefits:
- Operates in extreme temperatures from -253°C / -423°F to +260°C / +500°F
- Withstands high pressures in excess of 100bar / 1450psi
- Excellent wear and friction characteristics
- Compatible with virtually all chemicals
- Unrivalled cleanability in food & beverage and pharmaceutical applications
- Materials available compliant to FDA 21 CFR 177.1550, 3-A, USP Class VI, Cytotoxicity <USP 87>, NSF and the EU Machinery Directive
- Suitable for piston, rod, face, rotary, reciprocating and static situations
- Easy retrofit into standard AS-568 O-Ring and Variseal® grooves

Turcon® Variseal® NW

A flange seal where its Turcon® PTFE based case encompasses the energizing spring in such a way that there can be no possible contact between the spring or spring cavity and system media. Ideal for semiconductor applications, it can operate in a vacuum and is proven in fluorine gas.

Features:
- Operates in extreme temperatures from -253°C / -423°F to +260°C / +500°F
- Vacuum capability in air to 10-9mbar / l/s
- Excellent wear and friction characteristics
- Compatible with virtually all media and gases
- Materials available compliant to FDA 21 CFR 177.1550 3-A, USP Class VI, Cytotoxicity <USP 87>, NSF and the EU Machinery Directive
- Available in custom sizes or standard dimensions with easy retrofit of current NW elastomer seals
Turcon® Variseal®
SA

Spring-energized seals are sometimes prone to installation damage when they are fitted into small diameter closed grooves. The new Turcon® Variseal® SA is energized with a Slantcoil® spring which can accommodate more deformation than other springs. Additionally, the Turcon® Variseal® SA features a unique profile geometry which supports the sealing lip while the seal is being deformed. This allows it to be installed in closed grooves, even when these are of a small diameter.

Features and Benefits:

- Excellent sealing capabilities
- Operates in extreme temperatures from -70 °C/ -94 °F to +230°C/ +446°F
- Withstands high pressures up to 80 MPa / 11600 psi
- Excellent wear and friction characteristics
- Compatible with virtually all chemicals
- Suitable for piston, rod, face, reciprocating and static situations
- Easy retrofit into standard AS-4716 and Variseal® grooves
- Complies to the EU Machinery Directive
Trelleborg Sealing Solutions at a glance

- A business area of the Trelleborg Group
- Employees: 5700
- Research and Development Centers in Europe and America
- 30 manufacturing plants worldwide
- 40 Marketing Companies globally
- In-house polytetrafluoroethylene, polyurethane development and elastomer development
- More than 2000 material formulations
- Worldwide distribution network

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