Polymers for Use in Extreme Conditions

Oil and Gas Innovation sits down with Fluorocarbon, which has grown to become one of the UK's largest fluoropolymer processor and global supplier of PTFE, polymer related components and engineering plastics and stock shapes. Fluorocarbon helps readers understand why it's becoming entailment to use high performance polymers in extreme situations such as deep wells offshore.



OGI: Could you start by explaining Fluorocarbon's credentials and experience in terms of the applications of your products and services for the Oil and Gas sector? Could you tell our readers the breadth of your experience, how long you have been active, and your worldwide reach? Fluorocarbon has a few different product lines, which are of course applicable to various industrial sectors. And in terms the applications of your solutions, which sectors within the oil and gas industry do you primarily help?

Fluorocarbon: Fluorocarbon first entered the oil and gas market in the 1980's with manufacture of ball valve seats and inserts, and the supply of a range of Fluoroglide[®] PTFE skidway plates, specifically for load out of the BP Fortes jacket from Mcdermott's former fabrication yard in Ardersier, Scotland.

Since these initial projects, Fluorocarbon has continued to develop the manufacturing techniques and materials utilised throughout subsea and surface fluid handling applications and skidway load out systems. For example we are now able to offer a complete package for load-outs of Jackets and process deck skidway plates, which can include; Greenheart timber skid-shoes and lubrication systems incorporating both wet and dry lubricants (FL414 and FL614). Having established a dedicated seal business unit in 1993, we were able to support all seat and seal product and material development, bringing solutions to the challenge of fluid handling.

Over the years we have accumulated many hours of site attendance to understand the demands of the application. In regard to skidway solutions, we include the additional service of a Fluorocarbon engineer visiting the construction yard to discuss and advise on the options available for a low friction load out, followed up by a visit to train the customer's engineers on the optimal procedures for installation of Fluoroglide[®] skidway plates. Fluoroglide[®] skidway plates are used in construction yards throughout the world. To date Fluoroglide[®] systems have skidded structures of up to 35 000 tonnes with a friction value of 3-5%.

Valve seats and seals have been developed for many of the valve configurations such as Floating Ball, Trunnion and Gate valves, across the extent of oil and gas sectors, including cryogenic service of LNG, the full range of pressure class, extreme service of sweet and sour gas and refinery process plant. Furthermore, recent developments in polymer materials and design configuration enable Fluorocarbon designed products to address the demands of HPHT applications.

OGI: Technology is now paving the way for producers to reach oil which was previously thought to costly or too difficult to pump from difficult parts of the oil field. But temperatures in certain wells in these more "hostile environments" can be too taxing on traditional materials used to applications such as sealing. Could you explain how this works and what solutions are available for companies who are having this issue?

Fluorocarbon: The demand for hydrocarbons continues to grow and consequently the equipment required to extract these reserves, particularly from deeper formations, must address the increased pressure and temperature evident in deeper wells situated throughout the world. Typically, the industry defines HPHT as pressures above 15,000psi (1035 Bar) and/or temperature above 350F. (177°C)

In isolation, many high performance polymers are well within their working temperature limits at 300F (150°C), however, higher temperatures reduce the mechanical properties of polymers, particularly in regard to strength and creep resistance. The introduction of pressure then creates forces



which attempt to extrude polymers in to clearances and reduce initial interference. This reduces the products ability to maintain effective sealing over extended periods, particularly required of subsea installations.

Seal Designers and Materials Engineers need to innovate. Designers will consider configurations which may include novel antiextrusion devices which work to reduce the likelihood of creep.

Material improvements, by inclusion of fillers and their form and orientation, can increase the mechanical properties at elevated temperatures. Process changes can further impart flexural properties which allow the use of polymers traditionally too stiff to consider as energized seals for instance.

OGI: Could you enlighten our readers of the ways where you help clients with your products and services?

Fluorocarbon: Fluorocarbon have worked with many Wellhead and Tree component manufacturers, having supplied seals tested and approved in accordance with API 6A, and supplied at PSL 4.

These include valve stem seals, tubing hanger and stab connector seals. Each application has unique challenges that require bespoke solutions in configuration and material specification. For instance, Tubing Hanger seal stacks need to be double acting and provide a robust seal capable of withstanding long assembly travel.

Valve stem seals are required to provide critical environmental sealing, yet maintain manageable friction characteristics so as not to contribute to high torque loads.

In each case, Fluorocarbon engineers work closely with the component designers to ensure all aspects of the application, assembly and hardware are designed and specified for optimum service and performance of the fluid handling solution. Fluorocarbon also provide long lasting subsea solutions. We were approached in 2005 with a request for a slide bearing which would operate subsea, (1000mtrs) for 25 years between the PLETS / FLETS, and mud mat. The problems were that there was little information available or any history on the long term effects of sea water on a bonded Fluoroglide[®] PTFE bearing. Hence Fluorocarbon was unable to give any guarantees. The solution was to design a bearing using specially formulated PTFE which would not support any marine growth or the coefficient of friction be effected by long term service life on the sea bed. In addition the Fluorinoid[®] PTFE may be exposed to high UV concentrations where it could have been exposed during the installation period in the clients fabrication yard in areas of high UV levels prior to be lowered to the sea bed.

Fluorinoid[®] FL134, was the proven and specified material, for the PTFE sliding element. Having resolved the sliding element choice of material the second half of the problem was how to retain the sliding element Seal Designers and Materials Engineers need to innovate.



securely whilst allowing the PLET to slide against the Mud mat for a long period in excess of 20 years. A combination of mechanical fixing and adhesive bonding was evaluated and proven to be the correct combination for a slide bearing to be able to operate subsea for many years. This design has been approved by BP, Total and Impex. With a number of major projects completed, Fluorocarbon was further awarded the contract by McDermott's to supply a large quantity of J Bearings for long term service for the subsea pipe lines off Australia in Browse ICHTHYS project.

OGI: How can Fluorocarbon help a company who is dealing with this bearings issue? And how are the solutions implemented?

Fluorocarbon: Fluorocarbon's strength includes our skill in understanding exactly what the customer requires and converting the problem to a solution using 50 years of material development, new processing technologies and 30 years of personal experience. We have found that our engineers speaking directly to the client have a much better understanding of what is required rather than the traditional system of sales engineers reporting back before any action is undertaken. As a result of this approach we have developed specialised products and solutions for the oil and gas industries.

OGI: One of the Fluorocarbon products, mentioned previously, which are used worldwide by many industry players is the Fluoroglide[®] Skidway. Where is this technology used primarily? What size loads do these skids usually handle and are they bespoke solutions?

Fluorocarbon: Fluoroglide® skidway plates are generally made to suit a particular fabrication yard's specification. Fluorocarbon is able to manufacture skidway plates to a maximum size of 3000mm x 1500mm, plates of this size are difficult to handle in the yard and only called for in specific applications on the yard or barge skid beam. A typical skidway plate is 2000mm x 500mm which can be used in multiples to suit the loading on the skid beam. Normally the Skidway plate load-out system is considered viable for structure loads above 6000 tonnes, although many projects of lower loads utilise the system depending of complexity. Fluoroglide® skidway plates can be re-used more than once making them cost effective.

Seal designers and materials engineers need to innovate.

OGI: Finally, it is well known that Fluorocarbon has completed projects for many industry players around the world. Could you share with our readers of a particular case study where you helped a client with your products and services?

Fluorocarbon: Fluorocarbon's expertise in solving sealing and slide bearing applications is well proven but it is not always about load pressure or temperature!

A leading Oil and Gas service company manufactures steerable drills and bias units which incorporate a device used to protect the hardware during down-time and transportation. The former product was fitfor-purpose but had disassembly difficulties and was a disposable item.

Fluorocarbon was approached to address the difficulties and by observation and consideration of the handling methods and needs of the operators, a simple clam-shell clamp design was proposed. The quality of the product was better than the former component, resulting in re-usability after return, assessment and re-work where necessary. The material selected also allowed us to recycle the material of those that were scrapped. This ensured there was no waste or environmental impact to the disposal of the clamp, further supporting our policies and stance in regard to our ISO14001 approval. •

> To find out how we can help your latest project please contact: info@fluorocarbon.co.uk or visit our website: www.fluorocarbon.co.uk