OFFSHORE ENGINEERING POLYMERS

from IFS Chemicals Ltd.

Stena Apache Lay Barge

Introduction

The offshore industry is a massive worldwide business involving the extraction and transportation of oil and gas, often from deep reserves thousands of metres below the surface of the sea. In common with many other industries, the offshore business relies heavily on the use of modern, high-performance polymers, particularly polyurethanes. At IFS we specialise in solving industrial problems through the use of polyurethane chemistry. Our expertise has over the years involved specialist and demanding applications within the marine, aerospace and automotive industries. For the past 25 years, IFS has been responsible for major shifts in the development of environmentally-friendly products for numerous industries. The Company has also produced high-performance materials for use in demanding applications, particularly with regard to high service temperatures and cryogenic applications.

As part of this specialised formulating business, IFS has manufactured thousands of tonnes of polyurethane chemicals for the offshore industry. Many of these products are commonly used in sub-sea pipeline applications, either as insulation materials, protective coverings or in-fill products at pipe joints. IFS marine-grade polyurethanes have been used in the North Sea, the Gulf of Mexico, the Far East and the west coast of Africa.

Impact Test on Pipe Joints

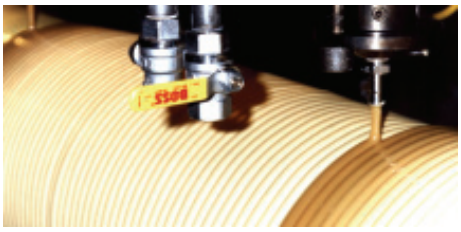
Foam Field Joints

Concrete-coated steel pipes have been used in sub-sea applications for many years. Individual lengths of pipe, often up to 1200mm in diameter, are welded on a lay-barge and placed in the sea often under rather difficult working conditions. It is imperative that the operation is carried out quickly and with minimum cost to the operator. This requirement led to the need for a fast field joint to allow the pipe to pass over a guide roller before entering the sea. IFS developed the 156/160 range of fast reacting foams which has become an industry standard for this type of work. Foams of this type are characterised by having rapid modulus development and high compressive properties at low density. Many hundreds of miles of sub-sea pipes have been successfully coated with foams supplied by IFS.

Solid Field Joint Testing

Solid Field Joint

A high-performance polyurethane elastomer for fast field joints (Cellacast 11.309) was introduced to the IFS range of marine products in 1992. A year later, it was first used on a major project, the 22km long Dunbar pipeline in the North Sea. It was later used on a similar application in the Shell Pelican oil field. This product fulfils all the significant design criteria for a field joint and is now available in a non-mercury catalysed form. The new product has been tested for long-term ageing and fulfils all the requirements demanded of a performance polymer in harsh service conditions. The standard system has a cycle time of 6 minutes but faster reacting versions are also available. Low temperature flexibility is a feature of the system, as is high impact resistance.

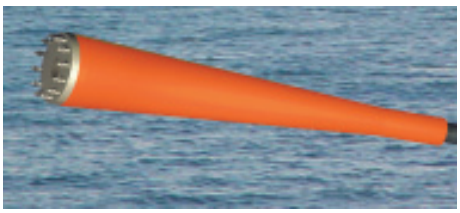


CRC Process with Syntactic Insulation

Insulation Systems

As well as a multitude of foam systems for marine applications, IFS has a range of syntactic polyurethanes, which have been developed for the insulation and protection of flowlines, spool

pieces, risers and manifolds. A variety of grades are available for water depths up to 3000 metres, with small variations made to allow processing by moulding, spray-application and CRC (Controlled Rotational Casting). Cellacast 11.270 is a high-performance syntactic material with a hardness of 90 Shore A and a two minute gel time. It was first used on the Lasmo Birch project in 1996 at a water depth of 127 metres. With a typical tensile strength of 6.7 MPa and an ultimate elongation of 60%, this product has proved to be the material of choice for sub-sea insulation applications. Glass syntactics are also available for moulding applications and are suitable for very deep waters. Typical insulation values are 0.14 to 0.16 W/mK. These products run with specialist isocyanates, which exhibit less tendency to cold-temperature solidification than traditional grades.



Megathane 85 Bend Stiffeners

Cellacast 24.324 Bend Restrictor

Protection Systems

Most of the syntactic foams act as both insulation and protection systems. However, certain engineering grades offer particularly high levels of protection and combine flexibility, low processing temperature, fast production rates and a stable, controlled hardness. The protection systems have been tested for extended periods of time in both air and sea-water, details of which are available from IFS. High abrasion-resistant polyurethanes are also available, all with the renowned technical service backup of IFS. For bend restrictors and bend stiffeners, IFS has developed a range of products based on high molecular weight PTMEGs, which run with MDI-based prepolymers. These products exhibit the very best performance in harsh conditions and each batch is fully tested to the strict requirements of ISO9001.

...high performance engineering polymers to handle the demands of the off-shore industry...

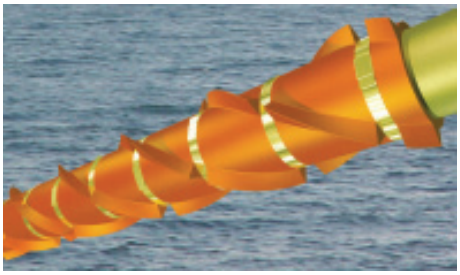
High Temperature Systems

The increasing demand for polymers offering higher resistance to temperature and hydrolysis has resulted in the HP-Series of products from IFS. Long-term testing has shown that modified polyurethanes are capable of higher levels of performance than the traditional elastomers commonly used by the marine contracting industries. Some 15 years ago, IFS developed a foamed polyurethane suitable for applications up to 150°C. The Company has now further developed this range of foamed, syntactic and solid elastomer products. For moulding applications, IFS has a range of novel, isocyanate-based materials which comfortably surpass traditional performance figures for engineering polyurethanes.

Rapeseed Oil Polyol Plant

Environmentally Attractive Systems

Many of the conventional syntactic and elastomeric polyurethanes manufactured by IFS are now available in grades that reflect the Company's commitment to environmentally sound chemicals. The replacement of mercury-containing catalysts was established some time ago. IFS led the way in this development, followed shortly thereafter by the elimination of TbT in antifouling grades. The Company then developed foam systems derived from both recycled materials and from renewable, vegetable-based polyols – again, a first for IFS. In terms of blowing agents, all marine grades of foam are expanded using water as the sole ingredient for this purpose.



Antifouling Elastomers for VIV Strakes

High Performance Elastomers

ISO9000 Registration

Batch Testing of Marine Products

Buoys

IFS has a range of polyurethane foams for buoyancy applications. The low density closed cell rigid foams have mechanical properties which are particularly suited to surface and near surface use. The applications for buoys manufactured from these products range from navigation buoys, marker buoys and anchor pendant buoys to large mooring buoys and pipeline tow buoys. The Company also supplies the external finishing material, a coating of a tough, fatigue-resistant polymer. The industry standard, Cellacast 4090, is a 90 Shore A polyurethane which is spray-applied to give a product optimised for high impact and resistance to abrasion. Moulding versions of this elastomer are also available and have been successfully used for buoyancy applications.

Quality

IFS pays great attention to quality and consistent performance from batch to batch, in line with the strict procedures within the ISO 9001 quality system. Production methods, including dedicated blending vessels, ensure that high-performance products are consistently produced. Quality control checks, including analytical and actual performance tests, are carried out on all batches of marine-grade materials. This ensures that all customers can totally rely on products received from IFS. Furthermore, in order to ensure that the best possible product is manufactured by the customer, IFS technical service personnel are always on hand to optimise processing parameters at the customer's premises. As far as quality is concerned, there are no compromises.

IFS - proven performance in harsh environments

IFS Chemical Group
Roydon, King's Lynn, Norfolk PE32 1AW
Tel: +44 (0)1485 601155 Fax: +44 (0)1485 601144
email: sales@ifsgroup.com website: www.ifs-group.com