

Issued by Norner AS  
May 2012

# NORNER NEWS ON

World leading capabilities in  
**Polymerisation**

Accredited facilities for  
**Pipe testing**



**4-5** Conferences and exhibitions

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**10-11** Test services for Pipe and Automotive

**12-13** Oil and Gas

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## 3@Norner



### **SVEIN H. JAMTVEDT**

*Hello, I am dedicated to polymer additivation and stabilisation. I make sure our customers will maximise their quality at minimum cost.*



### **ROGER DIDRICHSEN**

*Hi, I care for our capabilities in material durability testing and NORSOK 501*



### **ELINA MYHRE**

*I have been lucky to lead our project for processing studies of PET in extrusion blow moulding. It was a challenging task but we succeeded.*



*Our petrochemical clients have realised the value of our resources and capabilities of our polymerisation lab and polymer research team !*

**Tine Rørvik**  
CEO

## Dear reader

**I am pleased to present to you our second edition of NornerNews. Enjoy the reading about our latest achievements.**

Our industrial institute is dedicated to plastics. Our experts have worked in this field for up to 40 years. With more than 90% of Norner employees having global industry experience. This makes us capable of providing technological services that contribute to value creation directly to our clients.

More than half of Norner's growth is based on global international partnerships proving that our expertise attracts world leading companies. In our key segments; petrochemicals, additives, packaging and offshore industries.

If I should draw special attention to some highlights, it must be our breakthrough in Thailand and India the past year. In short time we have developed exciting research projects with major leading petrochemical companies.

We have worked hard in 2011 to broaden our capabilities

in the pipes business. Our broad range of test methods are ISO 17025 accredited for third-party control and we have ISO 17020 accreditation for factory inspection.

In our long-term development we focus on Norner Verdandi and Norner Mimir.

Verdandi invests in ownership and sale of technology developed by Norner AS and Mimir is a sales and advisory company in India, a rapidly growing market with a great need for expertise.

The success of Norner is founded on the people and that we together develop a healthy business with a lot of motivation and fun. Our achievements are reflected through good results in the yearly customer survey which shows that Norner is on the right track towards the future.

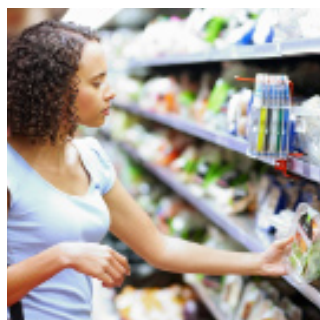
*I wish you an enjoyable spring!*

- Tine

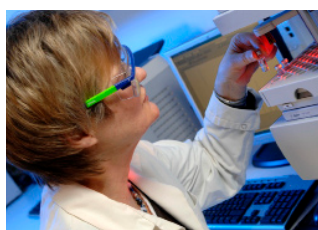
## MDO in the spot light

When Maack Business Services, now part of IHS, arranged their Speciality Plastics Film conference in Zürich last November, they addressed the promising opportunities with MDO orientation technology.

Norner was invited to contribute and Jorunn Nilsen gave a technical presentation about our results and experiences. Norner film advisors have long experience in MDO films and packaging industries.



## Additive insight @ AMI



Harry Øysæd of Norner shared some of his insight in additive performance at the AMI Polyolefin Additives 2011 conference. The main part of the presentation

covered novel insight from comprehensive studies of long term additive performance in contact with seawater at different temperatures.

## Norner Verdandi acquires 30 % of Econic

Norner Verdandi AS has invested in Imperial Innovations portfolio company, Econic Technologies Ltd (Econic).

The investment is made together with Imperial Innovations, who is a leading British technology commercialisation and investment group. Norner Verdandi is a daughter company of Norner.

Econic is developing catalysts that enable production of polymers, such as polycarbonates and polyurethanes using CO<sub>2</sub> as a feedstock. As a result, the proportion of petrochemicals in these materials is reduced, thereby giving significant benefits in eco footprint.

The catalysts have significant potential across the global polyurethanes and polycarbonates markets, which are worth around \$20 billion and \$11 billion respectively.



CEO Tine Rørvik of Norner (left) and MD Per Arne Sørlien of Norner Verdandi

Polyurethanes are used for products ranging from car seats to insulation foam and polycarbonates are used for products ranging from drinking bottles to coatings.

Following the investment, Norner Verdandi holds a 30% stake in the business. The new funds will be used for Research and Development purposes, as well as scaling up the catalyst production process.

For Norner, to join forces with Imperial is an important step forward towards the commercialisation of CO<sub>2</sub> based products that have been a key research field during the last 5 years.

## Echo2Eco

Norner has a leading role in a newly approved EU funded R&D project. The SMEs in this proposal have come together as a supply chain to develop a new type of sound absorber, for public and commercial non-residential buildings. The new and challenging solution will utilise micro slits in a 200 micron film. With our research partners and innovations in multi-layer polymer material formulation/lamination and novel laser beam/optics configurations we are confident we will succeed.

## iPad Winner

Ragnar T. Solgaard is the winner of our customer survey prize. Ragnar is packaging



manager at Tine, the Norwegian diary. He is impressed by our failure analysis team. We are very pleased with the good result of our latest annual survey.

## SafeRubber

Norner is a participating institute in this FP7 funded project. The goal is to develop a new, safe, multifunctional accelerator curative molecule which can replace thiourea-based accelerators in the vulcanisation process.





## FACTS

Norner Mimir India Pvt. Ltd.

Norner Mimir is the first subsidiary of Norner abroad and reflects our established business in India as well as the identified business potential in this region.

Norner Mimir has chosen New Delhi as the base for operation with an office in Statesman House, Connaught Place.

Norner Mimir has started up with a team of three specialists with diverse experience in the polymer value chain. Mr Ashutosh Gupta is heading the operation as Country Manager supported by Dr Shailendra S. Solanky in the petrochemical segment and Mr Rajish Raghu in the Converter and Brand Owner segment.



Lars Evensen  
lars.evensen@norner.no  
+47 3557 8138

Norner Mimir had its own stand at the 8th Ed of PLASTINDIA

which was arranged in New Delhi from February 1 – 6, 2012. This is one of the largest exhibitions globally and attracted 1,600 exhibitors and an estimated 150,000 international trade visitors.

Norner Mimir's debut in Plastindia was a major success. Our booth was visited by about 500 guests during the short week, keeping the team fully occupied. The Norner Mimir team was complemented by Norner CEO Dr. Tine Rorvik and MD of Norner Mimir Mr. Lars H. Evensen.

The visitors included people from the entire plastics value chain like polymer manufacturers, additive manufacturers, processors and the brand owners.

The Norner Mimir stand was a perfect platform to tie up with new clients and even more to take ongoing projects and discussions to the next step.

Our activities vary from long term innovation projects involving catalyst development to trouble shooting, and our 35+ years of industrial experience has proven to be highly valued in India.

Our presence at Plastindia was a strategic decision and an important step to further strengthen the presence in the Indian and Asian market.



# Meet us at

## - leading international events

### Stretch and Shrink film 2012

24-26 April 2012, Austria Trend Savoyen Hotel, Vienna, Austria.

Presentation by O.J.Myhre; "A new generation of collation shrink film with MDO technology"

### ONS 2012

Stavanger, Norway 28-31 August 2012, The leading exhibition for oil and gas industries. Norner will have stand at M 1198

**ONS**2012

### Plastic Pipes XVI

International conference in Barcelona, 24-26 September

### MoDeSt 2012

2-6 September 2012, Institute of Macromolecular Chemistry, Prague, Czech Republic

Presentation by Carlos Barreto: "Novel organic solvent free purification of poly propylene carbonate"

### Multilayer Packaging Films 2012

16-18 October 2012, Maritim Hotel, Cologne, Germany.

Presentation by Ole Jan Myhre: "Simulating barrier properties and shelf life"

### Scanpack 2012

Gothenburg, Sweden, 23-26 October 2012, The leading Nordic packaging fair. Norner will have stand at C 03:21

**SCANPACK**2012

### Polyolefin Additives 2012

23-25 October 2012, Maritim Hotel, Cologne, Germany. Presentation by Svein Jamtvedt "Non-intentionally added substances connected to use of additives in polyolefins"

### MERL Oilfield Engineering with Polymers 2012

23-25 October 2012, Millennium Gloucester Hotel, London, UK

### Flexible Packaging Middle East 2012

12 - 14 November 2012, Shangri-La Hotel, Dubai, United Arab Emirates

### Thin Wall Packaging 2012

3-5 December 2012, Maritim Hotel, Cologne, Germany



# We polymerise - our customers innovations



Morten Lundquist  
morten.lundquist@norner.no  
+47 3557 8038

Norner experts support developments at any step in the plastics market like catalyst, polymerisation, processing and product testing.

Catalytic polymerisation of olefins is our Core Competence.

- Theoretical knowledge and experienced operators
- Ziegler Natta, Single Site & Chromium catalyst systems
- Uni-/multimodal polymerisations (e.g. slurry+gas phase)
- Polymerisations in slurry, bulk, gas phase; also solution polymerizations
- PE homo-/copolymers
- PP homopolymers, random copolymers, heterophasic copolymers, etc.
- Advanced polyolefins like multimodal, functional or terpolymers.

Our catalyst and polymerisation laboratory has a good selection of pressure reactors available. Our high pressure metal reactors are in the range of 1 - 17 litres and can operate up to 350 bar and 340°C. We also have a range of medium pressure metal reactors of 60-200 ml in size which can operate up to 100 bar and 120°C.

The reactor set-ups are flexible and will be modified according to the need of our customer.

We make uni- and multistage polymerisation including prepolymerisation. The reactors run with continuous feeds for monomer, comonomer & hydrogen. Our comonomer experience covers linear and branched olefins from ethylene to decene, VCH, epoxides and CO<sub>2</sub>.

Based on the long experience of our people we can deliver you bench scale results with Industrial Relevance.

- Plant optimisation & troubleshooting
- Up- and downscaling from bench scale reactors to commercial production
- Full scale measurements & predictions based on bench scale results
- Selecting catalyst and polymerisation conditions
- Catalyst evaluation for best fit to defined applications
- Securing IPR early and "fast to market" development under full confidentiality

We are currently also running client based research projects for polymerisation of PVC, PS, PC, PUR and Polyols.

# Additive News

## - a step up in service



Harry Øysæd  
harry.oysad@norner.no  
+47 3557 8089

Additives are the key to deliver the required performance in more demanding applications. Polymer additives are therefore a very exciting R&D area leading to development of new applications of plastics.

Norner has a team of researchers and laboratory engineers, many with up to 30 years experience in plastics additives. Development and testing of different additive recipes for different thermoplastic materials is what we do every day. Norner runs a portfolio of customer projects in this field and is a key resource in several R&D programs. A success factor is our extensive contacts with additive suppliers, polymer producers and end users.

We want to share more of our knowledge in additives with our best customers. In the coming first issue of our "Norner Additive News" you can read more about the following topics;

### ADDITIVE RESEARCH NEWS

Presentation of Norner Additive Team.  
Guest Writer; Professor Norman Billingham, a Nestor within polymer degradation and stabilization

### ADDITIVE ANALYSIS

- Presentation of new analytic equipment.
- Purity analysis of different additives
- Analysis of specific- and overall- migration of additives, related to requirement in European Food Contact Approvals

### ADDITIVE PERFORMANCE TESTING

- New equipment for antistatic measurements
- New methods for Gas Fading, Filter testing and Friability
- Testing of polymeric materials for the oil industry
- Methods and equipment for of flame retardants

### ADDITIVE THEORY

Norner Additive Guide will be presented in addition to ongoing additive related projects. In this issue two main topics will be discussed in more details.;

1. Process stabilization
2. Ageing and Service Lifetime

### ADDITIVE NEWS

- New additives on the market
- Additive Company News
- Highlights from additive conferences with participation from Norner

### Our additive core team



From left in the front: Jøran Antonsen, Charlotte Waag, Kjærsti Lindvig. Behind: Roger Didrichsen, Sveinung Aasetre, Harry Øysæd, Asbjørn Holt and Svein H. Jamtvedt.





# Additive pro - increasing



Svein H. Jamtvedt  
svein.jamtvedt@norner.no  
+47 3557 8121

Additivation of polymers is a profitable business and the number of suppliers is increasing. We are very pleased to present our new initiative for the additives sector; a third-party prequalification service which will save the industry time and money.

#### ADDITIVE QUALIFICATION

All producers of plastics depend on a secure supply of their key additives with a high quality and consistent performance. For that reason all producers will carry out an internal testing and qualification to approve them. This also takes significant time in the view of the supplier. The tests are individually defined depending on end user application and requirement. E.g. the requirements regarding purity, NIAS and migration for food and pharma applications is increasing.

#### ADDITIVE QUALIFICATION CENTRE PARTNERSHIP

Norner is a capable third-party institution to carry out all the needed test scenarios, issue proper analytical certificates and coordinate the communication. A partnership will be presented and proposed to key polyolefin producers. The analytical cost will be covered by the supplier and the certificates will be owned by them.

#### BENEFITS OF THIRD PARTY

- The polymer producer will save resources for internal testing
- The additive supplier can use the results and certificates towards several polymer producers
- The independent results make it unnecessary to do the same analysis multiple times

#### NORNER OBLIGATIONS

Norner shall coordinate and perform required testing and facilitate that the test programme is according to polymer producer's requirements.

Norner shall issue a certificate and test report to the additive producer who is the owner of results.

Norner shall reserve capacity, provide efficient performance and give priority to orders related to this qualification service.

Norner will proactively scout for developments of new technologies, additives and communicate this in a newsletter minimum once per year.

#### PARTNER OBLIGATIONS

- The polymer producer shall send suppliers to pre-qualification of equivalents or new additives at Norner.
- The decision of implementation of new additives is a decision by the polymer producer



# equalification centre

## industry value and efficiency

### NORNER CAPABILITIES

We offer efficient high quality characterisation and performance testing of additives in Polyolefins based on experience built up over 3 decades and excellent competence within research and development.



### Development resources

- Small scale compounding
- Recipe development & -optimisation
- Benchmarking and Troubleshooting

### Analytical

- Additive quality, composition and purity
- Non intentionally added substances (NIAS)
- Fingerprint and RMS
- Additives in polymers
- FTIR, HPLC, GC, GC-MS, UV
- Migration, SML and OML

### Performance and durability testing

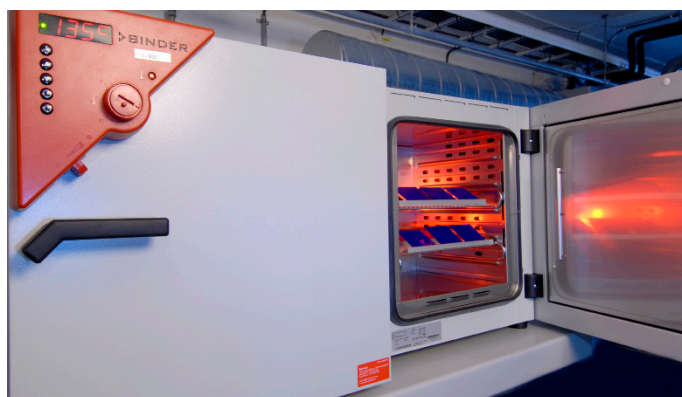
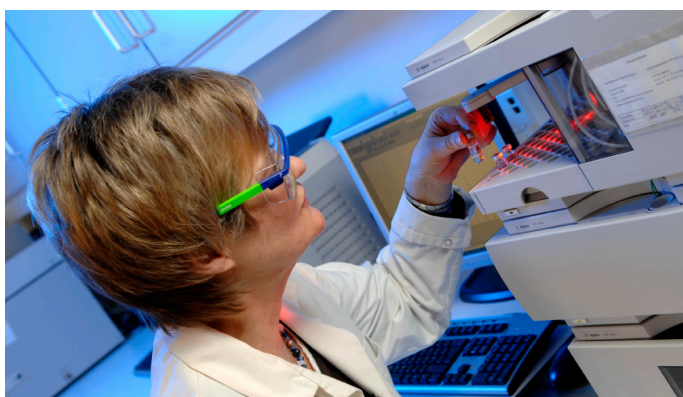
- Life time predictions
- Ageing in various media and temperatures
- Processing stability
- Antistatic, slip, antiblocking
- UV stability
- Effect of clarifiers and other nucleating agents
- Filter testing, Gas fading, Friability

### Procurement

- Reduce additive costs
- Fast implementation & cash realisation
- Supply security
- Pure additives, onepacks, types & grades
- Select additive with lowest NIAS

### Global database & extensive network

- Database and network with 100 suppliers
- > 30 years of experience
- Recognised speaker at conferences





# Pipe test centre

## ISO 17025 & ISO 17020

**NORNER laboratories perform several tests and investigations for pipes and other infrastructure installations. This includes accredited pipe testing services and pipe inspection. We have broad expertise on plastic raw materials, products and processing.**



Lene Sparre Thunes  
lene.sparre.thunes@nornor.no  
+47 3557 8043

We focus on development of plastic materials for plastic pipes and testing procedures.

Our test methods are ISO 17025 accredited for third-party control:

- Plastic raw materials for pipes
- Piping
- Parts for Piping

We offer third-party factory inspection according to ISO 17020 and testing and inspection of conditional state of pipes before installation and in operation. Important methods are advanced microscopy and chemical analysis of the plastic material. We also

make failure analysis of plastic products in the same way.

NORNER also contributed to the development of new test methods for approval of corrugated pipes.

### OUR KEY TESTING STANDARDS

EN 12201 Plastics piping systems for water supply and for drainage and sewerage under pressure - PE

EN 1555 Plastics piping systems for the supply of gaseous fuels - PE

EN 1852-1 Plastics piping systems for non-pressure underground drainage and sewerage - PP

EN 14758-1 Plastics piping systems for non-pressure underground drainage and

sewerage - Polypropylene with mineral modifiers (PP-MD)

EN 13476-3 Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of PP and PE

- If you need
- a new testing partner...
  - technologists that understand your materials...
  - experts in durability and stabilisation...
  - insight in material failure...

Contact us to discuss how we could satisfy your needs.



ISO 9001 CERTIFIED COMPANY



ISO 17025  
ISO 17020



# Fire Testing Laboratory



Henning Baann  
henning.baann@norner.no  
+47 3557 8085

We have improved and expanded our range of service areas. A well equipped fire testing lab is now available for you!

During 2011 we have trained our engineers and implemented a whole range of new test methods in our new "Norner Fire Testing Laboratory". This is well equipped for assignments linked to testing for a broad market of industries.

These facilities complement our offering to the industry in a good way and fit well to our long experience with testing and handling of materials and polymers. Norner offers service covering the whole value chain, from gas to plastic including packaging and end products.

The fire testing laboratory is now ready to serve industries like the Automotive and Offshore which are two of our main segments. It will also support key customers in the polymers, plastics, compounding and additives markets. Furthermore it will be attractive to paint, textile and upholstery as well as composites industries.



## New automotive test services

Our advanced laboratories have good flexibility and our personnel have long experience in plastics and development for the automotive industry. What is your challenge?

Our experienced engineers and scientists will help you with confident service and customized solutions.

The automotive plastic testing service is a focus area for us and we believe our wide field of expertise will serve customers better in terms of troubleshooting and testing.



### WE CAN OFFER:

- Specific automotive standards
- Tailor made testing on complete parts
- Smell / odour testing for automotive sector
- Emission, Environmental and VOC
- Durability, Fatigue and Weathering tests
- Flammability, FMVSS testing
- Insight in materials and additives
- Life time predictions
- Recycling expertise





# Material technology partner for the oil and gas industry



Heidi Hauggrav  
heidi.hauggrav@norner.no  
+47 3557 8073



Roger Didrichsen  
roger.didrichsen@norner.no  
+47 3557 8027

Since Norner started as an independent technology centre in 2007, we have been involved in several offshore-related industrial projects. This has been organised as client projects directly with the industry, and funded R&D projects.

In order to achieve this, we have invested in new laboratory equipment and method development and implemented a wide range of advanced testing methods and services for offshore applications. Examples of these methods are insulation properties (K-value) and compression set (ISO-815). We have also recruited technologists with extensive experience in the material technology needs of oil companies offshore.

**RESEARCH and DEVELOPMENT**  
We have participated in the funded project "Polyolefins for

demanding applications" which has enabled the development of unique expertise for long service life of polymeric materials in the marine environment with varying temperatures. In addition to basic research we have worked together with clients in developing new solutions for topside, subsea and down-hole use, with both technical and commercial focus. It is important that the solutions are commercially sound as well as technically feasible.

**MATERIAL TESTING**  
Norner has extended its laboratory for ageing and weathering durability with accelerated test methods for qualification of systems for corrosive protection in offshore and marine sector.

Norner offers qualifying tests according to Norsok M-501. This marks an important commitment to the oil, energy and marine sector.

Another important expert team at Norner is our microscopy lab with their long experience in failure analysis. They combine different microscopy techniques with other relevant analyses and have good knowledge of failure modes and mechanisms of aging in plastic materials. This team is also available as a 3rd part in surveys, failure investigations and condition monitoring.

"We have good capacity for testing of gaskets and seals, and are well underway to implement the NORSOK 710"



## Norsok M-501

# Antioxidant performance at real conditions is critical for service life

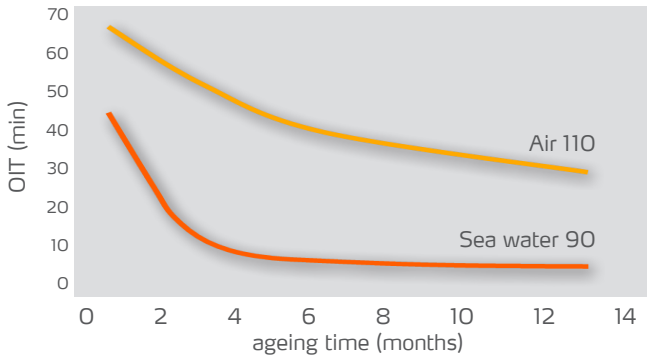


Figure - OIT of samples aged in air at 110°C vs. sea water at 90°C

The figure shows that the remaining stability is much less for sea water exposed samples even if the exposure in air is made at higher temperature.

OIT = Oxidation Induction Time is a measure of the polymer resistance to degradation.

The research project has carried out technical studies where plastic parts with defined material and additive recipes have been exposed to air, tap water or sea water at various temperatures and pressures.

The results show that plastic systems for marine applications needs specially tailored stabiliser systems.

Some key conclusions from our studies were:

- There are less remaining AO's in all samples aged in sea water, 90°C at 30 bars compared with the same materials at 1 bar.
- At 110°C the results show much higher AO conc. after dry ageing than after wet ageing.
- At dry conditions the depletion rate of AO1010 and AO 1330 are comparable. At wet conditions the depletion rate of AO1010 is much quicker.
- All in all it is still possible to design an underwater PP solution with the right AO composition for lifetime > 25 years.

# Fatigue performance of plastics is affected by processing parameters

Many plastic products on the market are exposed to cyclic stress. Fatigue is the progressive and localized structural damage that occurs when a material is subjected to cyclic loading.

Norner has now adopted a test method for fatigue testing of plastic specimens. The test method is based on ISO

One key results of the test is that we find large variations in properties as a function of processing parameters.

Norner is now able to remove the guess work and test your materials for fatigue life time.

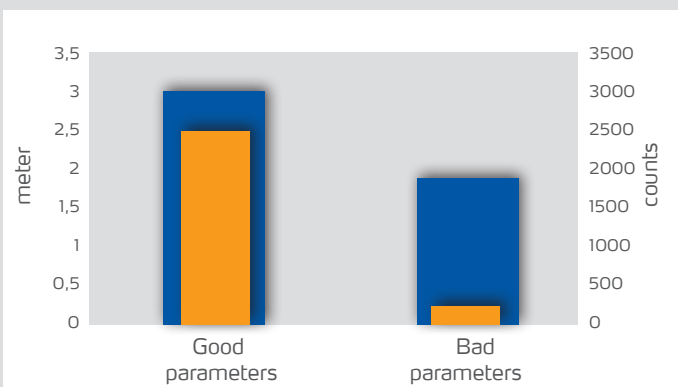
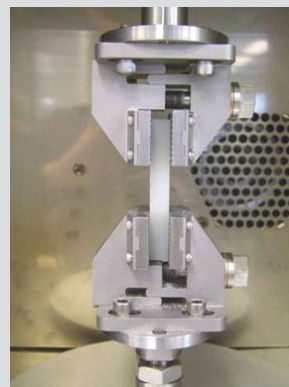


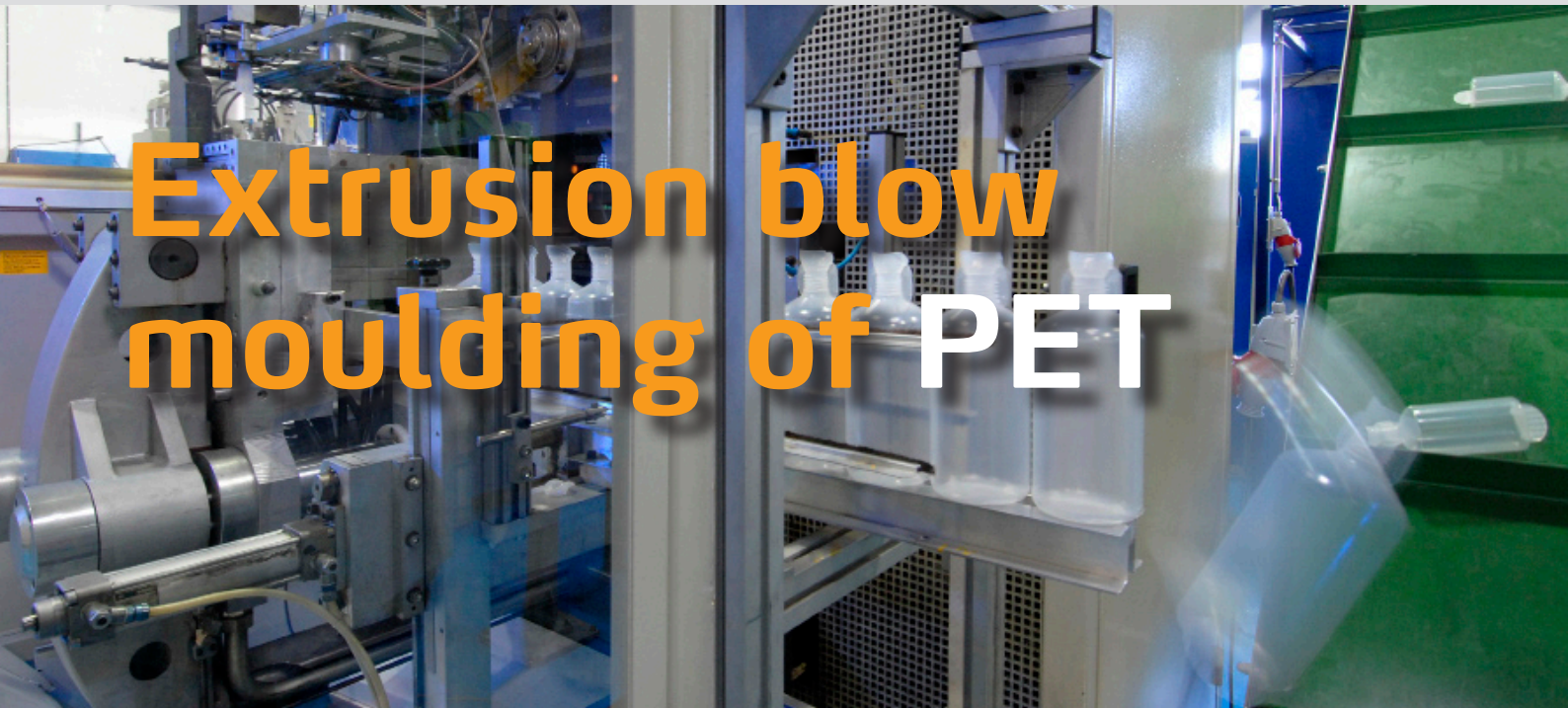
Figure - impact strength and fatigue resistance of rotomoulded specimens with different processing.



There are many factors that can affect fatigue-life, like:

- Geometry / design
- Processing parameters
- Temperature
- Material type – filler, pigment, additives
- Environment





# Extrusion blow moulding of PET



Elina Myhre  
elina.myhre@norner.no  
+47 3557 8059

PET is a packaging material for the future and new innovations keep coming to the market. Recently a new resin for EBM<sup>1</sup> has been introduced.

We have tested it and it works!

PET is an important and well known material in packaging applications and used in large quantities in flexible packaging, thermoforming and ISBM<sup>2</sup> bottles.

## PET MATERIAL DEVELOPMENT

The ISBM process lack the ability to form handles on the product. This challenge is being addressed by the polymer producers and Invista has now introduced their new Polyclear® EBM PET 5505 which is designed with higher viscosity and melt strength for use in EBM operations and is suited for containers requiring a handle. The products can be recycled in the standard PET stream.

## EXTRUSION BLOW MOULDING

The EBM technology is commonly used for polyolefins. A key question for this processing industry is how PET will behave on a conventional machine. We wanted to find this out and have carried out extensive testing and modifications on our EBM line.

Our line is a Fischer W. Müller BFB 1-6 EBM machine with a 24D grooved feed screw designed for PE and PP extrusion.

## SUCCESSFUL EXTRUSION

Our trials have been successful although we had several challenges. The photo below shows the bottles we have produced.

Main challenges vs. PE/PP:

- Drying of PET to achieve <50ppm H<sub>2</sub>O
- Extruder feed zone must be heated
- More sensitive adjustments of die gap and profile
- Higher extrusion temperature up to 285-295°C
- Parison cutting system must be modified
- High polished mould for transparency and gloss



<sup>1</sup> EBM = Extrusion blow moulding

<sup>2</sup> ISBM = Injection Stretch Blow Moulding



# Our free OTR simulator is now - updated with WVTR functionality



Morten Augestad  
morten.augestad@norer.no  
+47 3557 8057



Our free online tool for simulation of oxygen transmission rate (OTR) for packaging materials has become very popular.

The main objective of the simulator is to enable calculation of permeability for customer specific packages and geometries. Calculations can be made for film, laminates and flexible packaging, round or square cups as well as bottles.

## WVTR

We have now released a new tool for water vapour transmission rate, much asked for by our users.

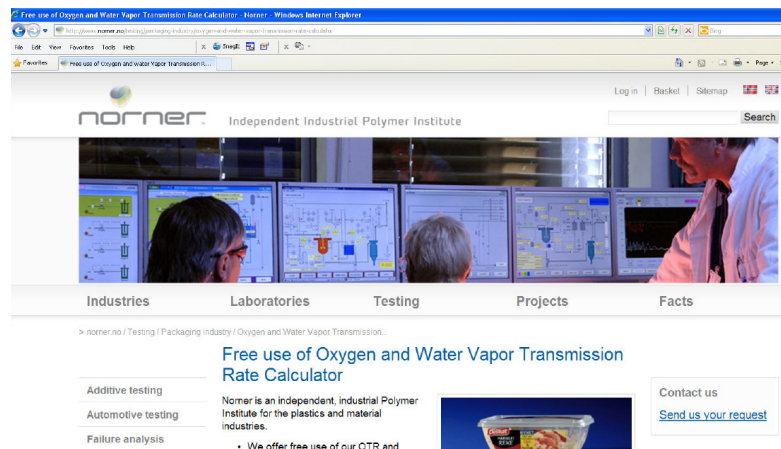
## FLEXIBILITY

The ability to vary the geometrical options, permeability properties and environmental conditions provides a useful tool for developers.

The model is highly suitable for simulation of package designs and structure in the development phase.

The user has the flexibility to specify number of layers, their thickness and the polymer in each. For the purpose of simulating real life situations it is also possible to vary the key environmental parameters.

Test it at [www.norer.no](http://www.norer.no) !



# SIBYL

## - advanced PO product database



Ole Jan Myhre  
olejan.myhre@norer.no  
+47 3557 8047



Sibyl is a new database created to give you a well of data that allows you to make real comparison of different grades of PE and PP for packaging applications.

## EASY TO USE DATA BASE

Our Sibyl database is now available for subscription and contain essential polymer data as well as a wide range of application related tests and properties. You can compare products and make your own graphic presentation. Sibyl database is easy to use. The data is easily viewed in a table of the selected products and properties.

Smart graphic options are available based on the selected data. You can generate graphic overlay plots

of rheology, DSC or FTIR curves. Furthermore XY plot, histogram and spider graphs of product data.

All graphics can be downloaded as picture files for convenient later use in your presentations or reports.

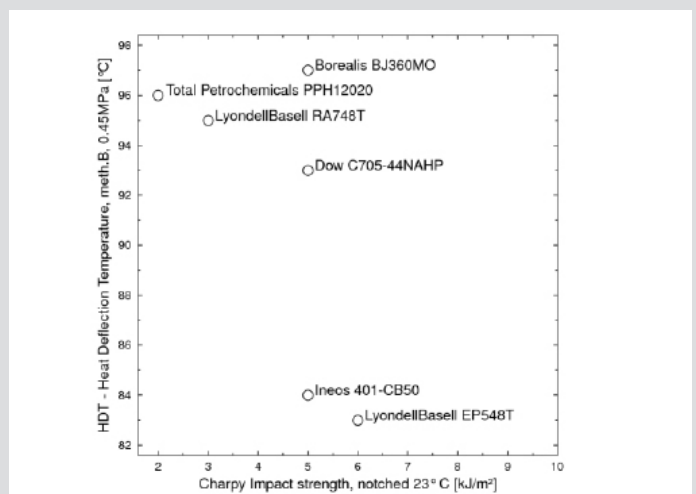
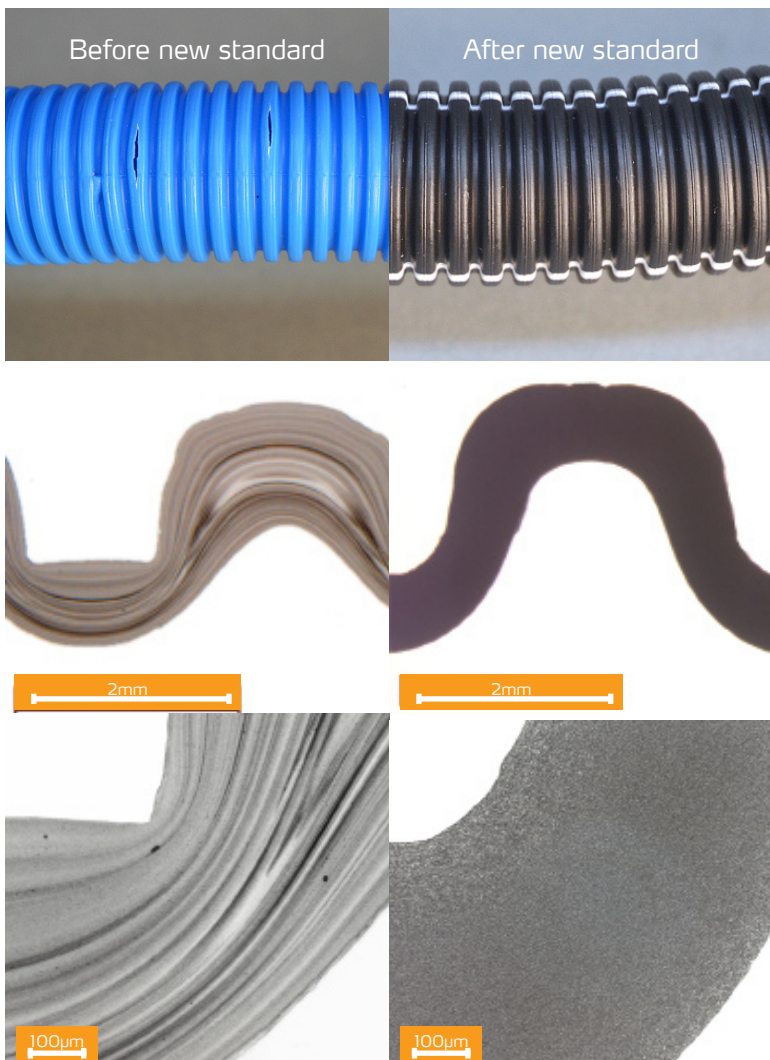


Figure - XY chart example of HDT vs. Charpy Impact strength for a selection of PP grades. Such graphs can be easily generated and downloaded.



## At the back

**Failure analysis and failure prevention is a key competence at Norner. In this way we help the industry save money.**

Pipe in tube solutions is becoming the main technique for installation of water distribution in domestic housing. The inner pipe is a PEX plastic pipe with very stringent regulations.

The outer corrugated tube has a security function of leading away potential leaking water if the PEX pipe gets a rupture. These tubes have had no regulations until recently and the quality has been poor resulting in cracking tubes and several insurance cases.

A new test scheme for approval was recently implemented in Norway and includes the analysis of several quality parameters by microscopy like;

- Pigment dispersion and homogeneity
- Raw material quality vs. gels
- Thickness distribution of the profile
- Presence of notches in the tube profile

Our core competence helps protecting the homes of our customers, reducing failures and saving costs.

### Did you miss our first edition?

You can access the first edition of Norner News through the following QR code or at <http://issuu.com/norner>



# NORNERNEWS



Norner AS  
Asdalstrand 291  
NO-3960 Stathelle  
Norway

Tel: +47 35578000  
Fax: +47 35578124  
Web: [www.norner.no](http://www.norner.no)  
Mail: [post@norner.no](mailto:post@norner.no)

