Daploy™ HMS Polypropylene for Foam Extrusion

BOREALIS Borouge

SHAPING *the* FUTURE *with* PLASTICS

About Borealis and Borouge

Borealis and Borouge are leading providers of innovative, value creating plastics solutions. With more than 40 years of experience in polyolefins and using our unique Borstar® technology, we focus on the infrastructure, automotive and advanced packaging markets across Europe, the Middle East and Asia. Our production facilities, innovation centres and service centres work with customers in more than 170 countries to provide materials that make an essential contribution to society and sustainable development. We are committed to the principles of Responsible Care® and to leading the way in 'Shaping the Future with Plastics'™.

Borealis is owned 64 % by the International Petroleum Investment Company (IPIC) of Abu Dhabi and 36 % by OMV, the Austrian oil and natural gas group. With EUR 5.7 billion revenue in sales in 2006 and 4,500 employees, the company is headquartered in Vienna and has manufacturing operations in Austria, Brazil, Belgium, Finland, Germany, Italy, Sweden and the United States. Borealis also has two innovation centres and customer service centres across Europe.
The company's main products are polyolefins and it produces also nutrients and base chemicals such as melamine, hydrocarbons, phenol and acetone.

Borouge is a joint venture established in 1998 between Borealis and one of the world's leading oil companies, the Abu Dhabi National Oil Company (ADNOC). Its headquarters, counting 830 employees, and its state-of-the-art world-scale petrochemical complex are located respectively in Abu Dhabi and Ruwais, the United Arab Emirates. Borouge is currently implementing a multi-billion dollar expansion at its Ruwais production facility. The project, called Borouge2, is due for completion in 2010 and will triple the company's polyolefin production capacity.

For more information:
www.borealisgroup.com
www.borouge.com

Contents

02 Polypropylene foam

04 Daploy™ HMS-PP

05 Foam extrusion process

08 Daploy HMS-PP blends and foamability

09 Providing PP foam solutions

12 Basic material data for the homopolypropylene HMS - grades

13 Basic material data for the random copolymer HMS - grades

15 Processing guidelines for PP homopolymer and randomcopolymer HMS - grades

Polypropylene foam

Polymeric foams consume around 3.5 million tonnes of plastics materials annually and account for about 10 % of all polymer usage in Europe. Foamed polymers are used in a wide number of application areas, which range from construction, automotive and household products to food and protective packaging. Among the many benefits of foamed materials are their good mechanical rigidity at low specific gravity, thermal and acoustic insulation, cushioning against mechanical shock and a significant contribution to source reduction in raw material usage.

The foam market is dominated by the amorphous polymers (such as PS, PU and PVC) which have been industrially foamed for more than 50 years.

Polypropylene (PP) foams are a relative late comer to this market. The reasons for this lie in the molecular structure – standard PP's are semi-crystalline materials with a linear molecular structure. They lack the required extensional rheological properties in the melt phase which are required for the production of extruded low density foams with a fine and controlled cell structure. This limitation is resolved by the Borealis Daploy range of High Melt Strength (HMS) PP products. These are long chain branched materials, which combine both high melt strength and extensibility in the melt phase. They open up the possibility of bringing the many well-known property benefits of PP into the world of low density polymeric foams. These benefits include a wide mechanical property range, high heat stability, good chemical resistance and no monomer issues. PP also brings its good environmental credentials to this market.

From a fairly recent and small beginning, the global PP foam market is growing rapidly (>20 %/year). Current PP foam applications include automotive, insulation, food and protective packaging. In Europe, the dominant PP foam applications are in the food packaging and automotive areas.

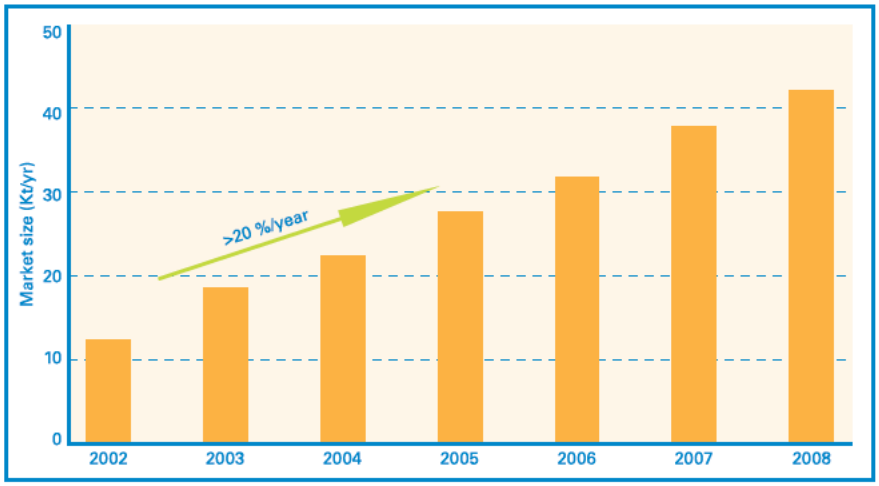

Figure 1: Global market growth for extruded low density PP foam

In the case of food packaging, PP foam offers a lightweight packaging solution with excellent grease/fat resistance (no stress cracking) and with no issues surrounding its monomer. Its high heat stability means products are microwaveable, with good thermal insulation giving them a 'cool touch' during removal.

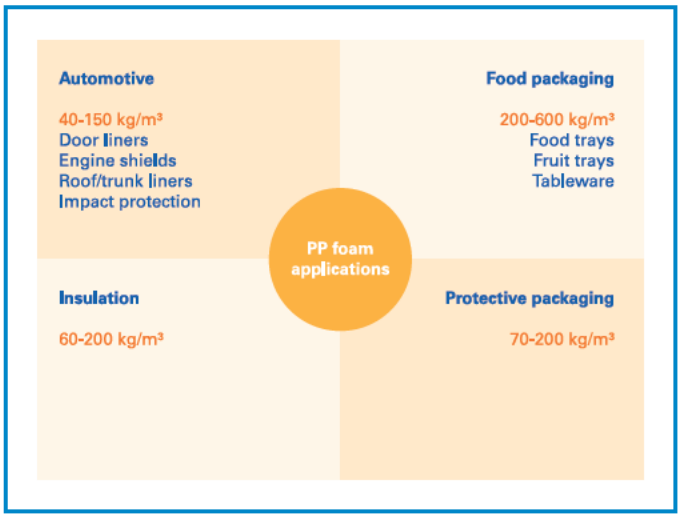

Figure 2: Some current applications for extruded PP foams

In automotive applications, lightweight foam solutions are helping to improve vehicle performance and fuel efficiency. With increasing pressure for end-of-life vehicle recycling, mono-material solutions are being sought and, with PP becoming a preferred polymer, recyclable foamed PP solutions are a logical next step. PP foams have an excellent moisture barrier and chemical resistance which are important for durability and functionality in the presence of hot oil, grease or fuel. Its high heat stability also opens up the possibility for under the bonnet applications. PP foams also have very good cushioning properties, thereby contributing to improved driver and passenger safety.

As a leading PP supplier, Borealis is committed to supporting the development of the extruded PP foam market through its Daploy HMS PP products and by offering PP foam solutions.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.