CARBON TRUST

Making business sense of climate change

Energy Efficiency in Plastics Processing

Case Study - RPC-Llantrisant

Infrared drying technology

PMMDA

“IRD is the most exciting new development in material drying I have seen for many years.”
Steven Jones
Technical Manager
RPC-Llantrisant

IRD uses new technology to rapidly dry and recrystallize PET materials

Introduction

Drying of hygroscopic plastics before use is vital for successful processing. This is particularly important for the processing of PET containers; both from virgin and recycled material and the energy cost is substantial. It is estimated that up to 15% of the energy used in processing these materials is used in the drying stage and that this can be reduced by up to 50% with new technologies.

Infrared drying (IRD) is a proven new technology for the pre-drying and recrystallisation of PET. IRD operates by using infrared radiation to heat only the solid polymer mass, the surrounding air remains cool and unaffected by the infrared radiation. IRD directly heats the core of the polymer to vaporise absorbed moisture that is then removed by a stream of cool air passing over the polymer.

The company

The RPC Group is Europe's leading manufacturer of rigid plastic packaging, offering products made by three main conversion processes; blow moulding, injection moulding and thermoforming. The group has over 40 autonomous sites in 12 countries and employs over 6,000 people. The group provides products to a wide range of customers ranging from large European manufacturers of consumer products (such as Unilever and Nestlé) through to smaller national businesses. Products are supplied to all sectors of the market but particularly to the beauty and personal care sector and the food packaging sector. The group was formed in 1991 through a management buy-out of UK plastics packaging companies and the Llantrisant site was acquired in 2004.

The Llantrisant site specialises in injection stretch and extrusion blow moulding and particularly in short run moulding of rigid PET, HDPE, LDPE, PP and PVC containers.

The Llantrisant site is investing in new production technologies to improve processing economics and the ability to process recycled materials.

The actions

Closing the loop

RPC-Llantrisant is a large processor of PET and the UK currently produces approximately 200,000 tonnes of PET plastic bottles annually, of which only 15,000 tonnes are collected for recycling. RPC-Llantrisant and UPM (the technology supplier) and have been working with Closed Loop London Limited in collaboration with London Remade and WRAP (Waste and Resources Action Programme) to investigate innovative processes for the recycling of post-consumer PET plastic bottles. WRAP is also supporting trials on the technical feasibility and customer acceptance of recycled PET in retail packaging to develop a more efficient systems for recycling food grade PET.

The energy cost for reprocessing is between 5 and 7% of the product sales cost and energy usage and cost reductions are very highly geared. There is therefore a strong driving force to reduce energy costs in the process to improve the economics of recycling.

The machine and application

Material drying accounts for over 15% of the total energy used in the production of PET bottles and a reduction in the energy used can have a significant effect on the process economics. Conventional dryers use desiccant beds, heater banks and high pressure blowers to pre-dry the polymer before processing. With IRD the polymer is conveyed to the inlet of a horizontal cylinder that incorporates an internal spiral feed. As the cylinder rotates the material is gently transported through the length of the cylinder by the internal spiral feed to pass under an infrared radiator that heats and dries the polymer before it is discharged from the cylinder to the polymer processing stage. Varying application requirements are accommodated by changing the cylinder diameter, cylinder length and the power of the infrared radiator.

The final moisture content of the polymer before processing is a function of the residence time in the cylinder and temperature both of which are controlled automatically by the rotation rate of the cylinder and the power of the infrared heaters.

The benefits

Comparative power consumption studies have been carried out between IRD and a conventional desiccant dryer fitted with power saving technology. The conventional dryer had an energy consumption of 0.125 kW/kg/hr and the IRD had an energy consumption of 0.095 kW/kg/hr. These studies were based on identical virgin PET material, throughput rate and final moisture content. The IRD process therefore shows an energy use reduction of 24%.

Recycled PET not only needs drying but also needs recrystallisation, with the IRD process a separate process step for recrystallisation is not needed; the two processes can be carried out in one pass and recycled PET (as a blend with virgin PET) can be crystallized and dried in one pass.

The studies also showed that the time taken for the IRD process was considerably less than that for conventional dryers, i.e. the crystallizing and drying time is approximately 8 minutes compared to 6 hours for conventional dryers.

Transferring the lessons

The lessons learnt from the use of IRD at RPC-Llantrisant are readily transferable to other UK plastics processors using similar processes. They can be used to reduce energy usage and costs in many companies.

The benefits of IRD are directly applicable to all processors and re-processors of PET. The rapid response and the ability to combine drying and re-crystallisation in one pass means reduced energy use and costs.

There is a need to retain and improve the financial incentives to recycle products; this can only be done if the most energy efficient technology is used and if the process productivity is high. The IRD technology can reduce the energy used and the cost of recycling and therefore increase the amount of PET recycling carried out in the UK.

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RPC Containers Ltd
Llantrisant Business Park
Llantrisant, Rhondda Cynon Taff,
CF72 8SH, Wales