FACT SHEET

Recycling and Recovery of Polyurethanes

RECYCLING AND RECOVERY POLYURETHANE FOAM FROM APPLIANCES

Legislation

The EU regulations for the electrical sector are Directive 2002/95/EC and 2002/96/EC. The WEEE Directive 2002/96/EC, which encompasses an updated text adopted in January 2012, has increased collection targets up to 65 % in 2019, reduced and limited export and includes other more demanding goals such as a separate 5 % reuse target. In Category 1 products, which includes refrigerators and freezers, the re-usable and/or recyclable parts from large household appliances must form a minimum of 85 wt % (weight percent) of a product and the recoverable components a minimum of 95 wt %.

There are several other legislations dealing indirectly with plastics and plastic waste, including ecodesign in general, ecodesign for energy related products (2009/125/EC) or other proposed energy efficiency directives (SEC(2011) 779 final).

The most important driver for more use of polyurethane (PU) will come from the present debate on increased efficiency for appliances and energy consumption products in general.

Market Size

The PU rigid market composed of refrigerators, freezers and cooling transport applications in trucks is the third largest market sector, following automotive application. The EU27 has limited appliance manufacturing capacity when compared historically or comparatively with the size of the population. Imported refrigerators are hence a dominant sector of this market. Average plastic content per refrigerator is around 20 wt %. Other polymers are mainly used to make the internal wall and smaller internal movable parts. PU is the dominant foam insulation used in the refrigeration market.

Application Description

PU and Polystyrene (PS) are the dominant polymers in refrigerators as current manufacturing technology connects the outside metal sheet housing and the PS internal wall using foamed rigid PU. The manufacturing technology requires fast and efficient manufacturing on almost fully automated assembly lines.

PU Product Characteristics

The different types of appliances can be manufactured with a tailor-made PU product mix. The product properties range from light foam with high to extremely high thermal efficiency. The legislative drive to reduce energy efficiency in the EU and other parts of the world has lead to sophisticated small to micro cell structures with different cell gases depending on the market.

Recycling & Recovery Technologies

At present the 80 % reuse and recycling quota and the 5 % energy recovery quota can be achieved without a special effort to dismantle plastic parts such as PS or PU manually. The recovery of the old (Ozone Depleting Substances) cell gases is required by law in the EU. Hence a two-step plastics recovery technology is used today after the metal and component parts are separated. In the first step thermoplastics can be separately recovered. Afterwards a PU grinding operation follows to recover almost all ODS from the PU cell. Early initiatives by the OEMs and market interest groups in the smaller EU countries have shown that other techniques such as dismantling of PU containing parts is not possible and or eco-efficient. Shredder treatment technology and the further refinement by companies such as Salyp or Sicon, and new post shredder technologies have shown the cost and limits of achieving the 85 % R&D quota.

Eco- Considerations

The cooling appliance sector is currently facing challenges due to the tremendous amount of electricity it uses. In the future, PU materials will further reduce the electricity consumption directly through improved PU foam structures. This will allow continuity with current metal/plastic manufacturing technology.

A classic conflict exists between legislative demands on climate change and lower CO2 emissions, and resource conservation through recycling, which needs to be evaluated together with a total life cycle balance.

Cost-effective sustainable results are achieved by applying the quota to all materials. The overall quota for cooling appliances waste allows many options to be combined and the careful weighing of dismantling, logistics and R&R technologies to achieve cost-effective sustainable results.

References

See Fact Sheet List of References and suggested reading material.

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