Recycling XLPE from cable waste

Ramona **HUUVA**, Elisabeth **RIBARITS;** Borealis AB, Stenungsund, (Sweden), ramona.huuva@borealisgroup.com, elisabeth.ribarits@borealisgroup.com

ABSTRACT

Recycling of cables can be more than just to recover valuable metals. It can be a complete process, which takes care of the complete cable, meaning recovering metal parts and make use of the plastic waste. Ideally, the XLPE (insulation and semicon) will serve as a valuable raw material for use in new applications in a similar manner as the metallic parts.

When recycling XLPE care needs to be taken and refined techniques need development; this is to make sure the resulting recyclate is clean enough to be (re-)used in cable applications. This paper deals with six potential XLPE recyclates manufactured by different recycling companies.

KEYWORDS

Cable waste, XLPE, mechanical recycling, recyclate, plastic, insulation, semiconducting, sustainability

INTRODUCTION

Today cross-linked polyethylene (XLPE) is a well-proven insulation material system used in cables all around the world and has a proven long life cycle (more than 40 years). A complete cable insulation system includes both semiconducting material (cross-linked material) together with the cross-linked insulation material, hereafter named only XLPE. Both cross-linked materials entitle as a long lasting material which reduces the environment impact. In fact, XLPE cables contribute, not just by lasting long, but also indirectly in a positive manner to the environment by allowing e.g. renewable energy power to be transmitted over long distances.

However, there is a high ambition to reduce the environmental burden and increase the recycling of all plastic in general from the EU commission [1] and this includes long lasting plastic products such as cable materials.

Regarding cables insulated with XLPE compounds it is evident that the environmental impact is already low but recycling the XLPE would even further contribute [2].

Incentives for recycling XLPE

Cable recycling operations are traditionally focused on metal recovery as the high value stream whereas the plastic fractions are mostly sent for heating (incineration) and sometimes to landfill. Landfill is not a sustainable solution and should be avoided, in line with EU zero plastics strategy [1] [3].

For every ton of plastics that is recycled rather than incinerated, three tons CO_2 equivalents are saved. Worldwide a reduction of landfills can be noted and since more than 10 years ago Sweden banned this type of end life destination. In 2015, the EU commission came out with a circular economy strategy followed by a specific plastics strategy in 2018. The ambition is to increase the recycling of plastics in general and for packaging materials in particular. Furthermore, in 2018 China banned import of plastics from Europe and Sweden is now pioneering moving towards a fossil free burning society [4]. In 2018 a new plastic recycling plant started in the South of Sweden focusing on all kind of plastic recycling [5]. There is definitely a progress and an effort taken by the plastic industry to be able to make use of the plastic fractions available on the market. The new processes for recycling of plastics in general have proven to be effective.

These and coming initiatives will most likely also push long life materials towards recycling. Cable materials such as XLPE compounds belong to this category.

Today most of the cable waste is incinerated or used for landfills in those countries where this is not yet banned. The question is, can XLPE waste be converted back into a raw material? Perhaps a different mindset is needed to do so; Instead of incinerating our plastic waste we can actually turn them into something valuable and even get the raw material back into the cable stream again.

There is definitively an increased interest in circular economy and a higher environmental awareness in the industry. In line with this awareness, many parties e.g. cable manufacturer and plastic producers are considering on how to recover other constituents besides the metallic parts of the cables such as the cross-linked cable core material.

Recycling of cable waste is indeed not novel, the metal parts have been recycled for many years [5]. Although the recycling of XLPE has been on the table for the last decade, we have not yet reached the same maturity and usage of this recyclate. With better sorting and separation methods, together with a washing technique followed by drying, XLPE can become a recyclate similar to other plastic materials.

XLPE material in general is not possible to be remolten to be used again due to its chemical bonds as result of the crosslinking process. However, Boss et al [6] demonstrate a process on how to turn XLPE into a valuable recyclate. The XLPE waste is grinded and then compounded together with PP and PE materials for new applications. Several techniques for refining the methods for creating a suitable recyclate are possible cryo-milling is one example of such a technique [7]. Another refining technique belongs to the metal separation such as magnets and shaking boards.

Besides mechanical recycling, an interesting future option is also chemical recycling. The consortium “Sustainable Chemistry 2030” in Sweden is looking into a recycling refinery [8].

DEFINITION OF RECYCLING

Recycling is a process of converting waste material into new materials and products. It includes the reprocessing of the material but does not include energy recovery or use as fuel. Recycling can decrease the waste of potential (re-)