

Description:	<i>Recycling options for polymeric materials</i> <i>Recycling of polymeric collectors</i>
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Introduction

Today recycling has become one of the key topics in the last years because of the increasing amount of waste and the waste itself is already an important resource of raw material. The amount of polymeric waste has increased significantly over the last decades, especially. As a consequence different recycling options for polymeric materials were established which are outlined in the following. Subsequently challenges and opportunities concerning recycling of polymeric solar collectors are discussed.

Recycling technologies for polymeric materials

Three principal recycling options for all polymeric materials are available: mechanical recycling, chemical (feedstock) recycling, and thermal recycling (energy recovery).

Mechanical recycling is defined by recovering material from waste while maintaining the polymers' molecular structure. This is done via mechanical processes (e.g. grinding, washing, separating, drying, re-granulating and compounding). To reach a win-win situation from an environmental and economic perspective, large amounts of clean not aged and homogeneous polymeric waste is necessary. [1]

Chemical or feedstock recycling is defined by recovering the components out of the source material. The used polymer is intentionally degraded to small molecules (feedstock of the material). These molecules can be further used as raw material for the chemical (and plastic) industry. Various processes that can be utilized include chemical depolymerisation, gasification, thermal decomposition (pyrolysis and thermal cracking) and catalytic thermal decomposition as well as reducing agents in blast furnaces. [2]

Thermal recycling can be regarded as the last way out for polymeric waste recycling. This approach is usually used for strong diluted, contaminated, and mixed polymeric waste without any treatment processes. The energy of the polymeric feedstock is recovered and can be used for producing electrical and thermal energy. Due to the material's different chemical composition in a non-homogeneous mixture of waste the incineration process should be equipped with a complex off gas treatment. In this process the polymeric structure material is completely decomposed. [3]

Recycling solar collectors

Studies point out that – in contrast to every day used polymeric products like water bottles – polymeric materials and components with an operating lifetime over 20 years [4] are not captured by the existing waste collecting systems [5]. Thus recycling of polymeric solar collectors might be challenging – also the

operating sites spread all over the world (maybe refund systems will work in the future). However, during operation ageing processes also take place and polymers degrade. This leads to different material properties at the end of the product's lifespan. Thus, feedstock recycling (chemical or energetic) might be the preferable option for the recycling of polymeric solar collectors. However, numerous questions arise, which should be addressed in future SHC Tasks and research projects:

- How is it possible to collect the used solar collectors?
- Is it possible to avoid mixtures of different polymeric materials in order to facilitate easy recycling?
- To what extent is the polymeric material of discarded collectors degraded during operation?

References

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