

Influence of natural zeolite on the total carbon emission in post-consumer recycling plastic

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Introduction

Zeolites of natural or synthetic origin have an extraordinary crystalline structure, whereby only a few grams of zeolite can provide several hundred square meters of surface on which substances can accumulate or chemical reactions can take place.

In the performed test series, a post-consumer recycled plastic was mixed with different quantities of a finely milled natural zeolite (LithoFill MM, Lithos Natural GmbH). The produced granules were analyzed by headspace GC for their total carbon emission, and further processed into test specimens to measure the mechanical properties. For evaluation of the interface, scanning electron micrographs were taken from the cryo-fractured cross sections of the produced specimens.

Results

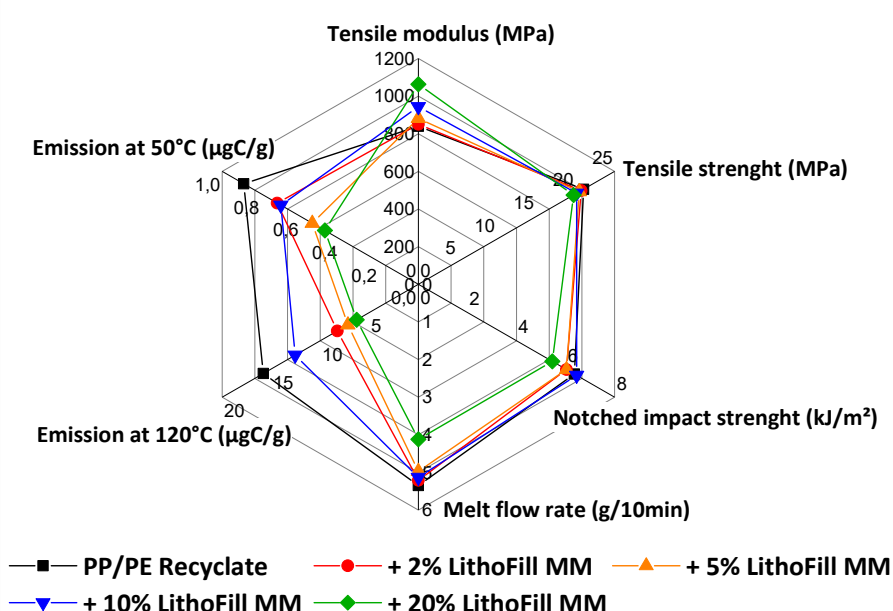


Fig. 1: Comparison of mechanical, rheological and emission values of the produces recyclate/zeolite compounds.

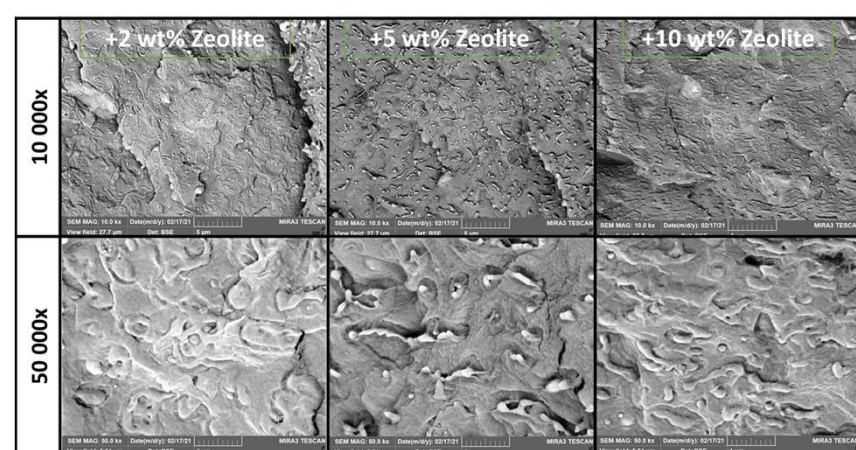


Fig. 2: Scanning electron micrographs of cryo-fractured test specimens with 2, 5 and 10 weight percent zeolite content show an excellent bonding between the zeolite particles and the matrix material.

Mixing post-consumer PP/PE recyclate with LithoFill MM is easy for low and high filling contents. While the stiffness enhances with rising zeolite content, the melt flow rate decreases slightly (fig. 1). The bonding between the matrix and zeolite particles is excellent (fig. 2). The total carbon emission of pure recyclate multiplies, when the virgin material is heated and processed. The addition of natural zeolite reduces the emission, whereby drying before compounding is important (fig. 3). Figure 4 shows, that the characteristic peak at 13 min gets clearly smaller the more zeolite is added. Some small peaks occur probably caused by the zeolite itself. This effect could be minimized by an adapted pretreatment.

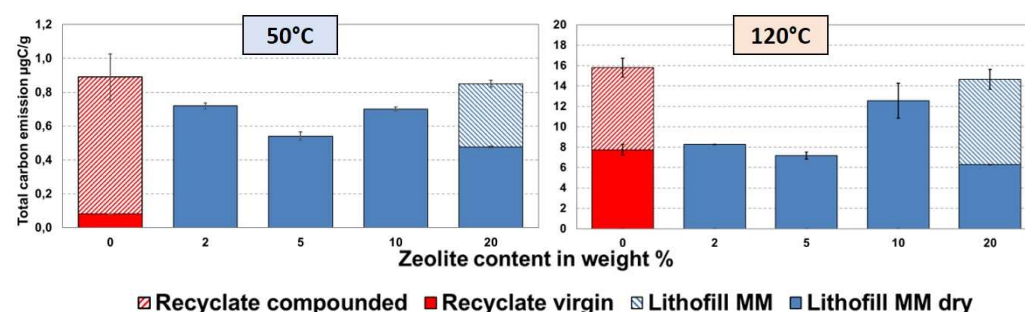


Fig. 3: Total carbon emission of compounded granulate at 50°C and 120°C versus zeolite content in PP/PE recyclate.

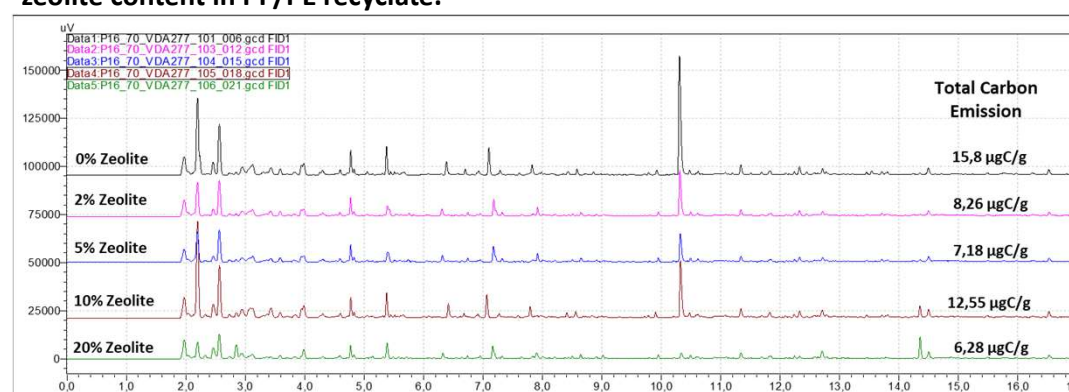


Fig. 4: Chromatographs of the recyclate/zeolite compounds with total emission values.

Conclusion

It showed that even small amounts of LithoFill MM diminished total carbon emission of the produced recycling granulate, where the pretreatment of the zeolite is crucial. The bonding of zeolite in the polymer matrix is excellent and the mechanical properties stay fairly unchanged. Further investigations about different pretreatment possibilities of natural zeolite will be done, to improve the existing adsorption capacity of natural zeolite.

Acknowledgement

The authors are grateful for financial support from the Austrian Research Promotion Agency (FFG) for the project "ReZeoSorb" in the program scheme "Bridge".

