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Life Cycle Assessment for Thermoplastic Elastomers Based on Electron Beam-Assisted Recycling of Polyolefin and Rubber Waste

R. Zeumer, Uwe Gohs, Kathrin Harre (University of Applied Sciences HTW Dresden) – Germany, D. Constantinescu (S.C. Monofil S.R.L.), L. Mészáros (Budapest University of Technology and Economics) – Germany

Increasing production rates of plastic and rubber products combined with a lack of effective recycling methods have led to an exponential growth of waste in landfills and incineration. For plastic waste, mechanical recycling and sorting into different polymers are still challenging. Mostly physical sorting methods are applied, which cannot be used successfully for mixed polyolefin waste, due to their similar physical properties. A promising way is the application of electron treatment to sort recycled polyolefins.

Crosslinking of rubbers prevents recycling via melt processing. One way to recycle cross-linked rubber is the mechanical recycling into ground tyre rubber particles (GTRP). Together with thermoplastic polymers like polyolefins, this elastic filler can be used to produce thermoplastic elastomers by melt mixing.

In this study, a life cycle assessment was performed to compare the environmental impacts of mechanical recycling of rubber and mixed polyolefin waste as well as the conventional production of virgin rubber and polyolefin. Real industry data was combined with environmental database information. The results of this study will contribute to the understanding of current and future recycling processes and will help guide future research towards innovative solutions of the global plastic waste problem.