Project Call

Deutsches Institut
für Kautschuktechnologie e.V.

EcoRubber - Simulation-based sustainability assessment of elastomer products and manufacturing processes in the rubber industry

Initial situation

Considering climate protection as one of the most important elements of the EU's "Green Deal", the focus is on climate change and the observed global warming due to the emission of so-called greenhouse gases (GHG), whereby the emission of CO_2 is considered to be the main driver. Accordingly, all emitted gases contributing to global warming with a greenhouse effect (GWP - "global warming potential") are standardised as CO_2 equivalents. The "carbon footprint" (CFP) of a product is its potential contribution to global warming, taking into account all significant quantities of greenhouse gases emitted and removed in the course of the production, use and life cycle of a product. (DIN ISO 14067). In detail, the life cycle stages "raw material extraction", "production", "distribution", "use" and "disposal / end of product life" are to be taken into account: (DIN ISO 14067). Against this background, the reduction of CFP through the avoidance (decarbonisation) of fossil materials and through energy savings in the process chain is of great interest. With the first draft of the European climate protection law to save 55% CO_2 by 2030 and to be climate neutral by 2050, the CO_2 balance of products becomes a procurement criterion in industry and thus a challenge for the entire supply chain, which also applies to the rubber industry. The rubber industry with its 73,000 employees (according to WDK, 2021) is one of the most important suppliers to the automotive and other industries. Large companies such as car manufacturers, which are often at the end of the supply chain, are increasingly pursuing corresponding climate targets. This massively increases the pressure on suppliers, who are required by OEMs to provide information on the CFP of products along the manufacturing chain. Currently, there are already numerous methods for assessing the environmental impacts of various industrial systems, but these approaches are very specific due to the product- and process-related interactions in the production cycle. In the rubber industry, there is currently a lack of suitable approaches to validly determine the CO2 life cycle assessment and the CFP of products and semi-finished products, even though procedures and instruments for balancing and determining the environmental footprint of a product (PEF - Product Environmental Footprint) exist in principle. The latter is used for concrete sustainability assessment and represents a method based on LCA (Life Cycle Assessment) for quantifying the environmental impact of products. Against this background, in the area of rubber production, the extraction of the large number of raw materials required must be included accordingly, as well as their transport, and the energy required for their processing (mixing, rolling, calendering and for the production of the end product (shaping through e .g. extrusion or injection moulding and subsequent vulcanisation). In addition to the diversity and high number of raw materials, the highly segmented production chain of rubber manufacturing in particular makes it difficult for small and medium-sized enterprises to provide a complete assessment of elastomer products by means of LCA or PEF according to the applicable standards. Also, according to a study by the German Rubber Society (DKG) in cooperation with the DIK, it is currently extremely difficult to determine detailed data for the energy expenditures and the CFP influenced by them against the background of the extremely complex manufacturing processes of rubber compounds and products. To facilitate the determination of the CFP of products, other manufacturing industries already use secondary data to approximate upstream production steps when assessing the PCF/PEF. However, the quite sensible concept of using secondary data is currently still failing in the rubber processing industry due to the overall low availability of databases. Companies often do not know in detail the parameters for optimising and reducing CFP.

https://bizwhiznetwork.com/15-ways-to-reduce-your-carbon-footprint/

Aims of the project

- To develop an applicable database as well as practicable analysis and prediction models for the sustainability assessment of rubber production processes and products.

- Extension of control variables via a development of partial PCF/PEFs, for multivariable optimisation with regard to costs, time, improvement of competitiveness.

- Delivery of a tool to meet the increasing demands (e.g. from OEMs) in connection with their climate policy and the ESRS – European Sustainability Reporting Standards (needed in the future)

Solution

- Recording of all relevant characteristic data for the calculation of a PCF on the basis of demonstrators including formulation, mixing, extrusion, injection moulding, pressing, vulcanisation) in the DIK. Transparent tracking of costs (transport, personnel, energy, investment overhead), transparent tracking of energy use (production, transport, waste, buildings), time (production, transport), determination of price for OEM, intermediate product PCF/PEF, and delivery times.

- Digital description of the production processes and supply chains of the example products, process sketching for the LCA database "Rubber" regarding forward process simulation (time, costs, PCF/PEF), optimisation (time, costs, PCF/PEF) under constraints (de-sign, legal framework, costs, delivery times) for future linking with DIK database "MAT-AI" and for providing recommendations for action.

- Develop a validated fully comprehensive calculation method for PCF/PEF.

- Creation of a comprehensive database including LCA databases and soft-ware tools.

Organisation:

Project implementation.
Deutsches Institut für Kautschuktechnologie e. V. (Prof. Dr. Ulrich Giese). Cooperating partners: Prediction GmbH/Untitld GmbH (Moritz Lindner), Prediction GmbH, (Dr. Nils Hendrik Kröger),

Costs.
Funding by industry partners (consortium). / - Duration: 2.5 years. / Costs: max. 20,000 EUR plus VAT per participant/year

Contact:
Please reply up to 31. October 2023

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