Advancing circular economy and closed material cycles by improving chemical recycling processes through thermal analysis

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A sustainable industrial society can only be achieved by recycling all raw materials used in a product at the end of its life. This goal must be achieved equally for mass-used consumer products made of plastic as for rare and expensive raw materials used in batteries, for example.

In the presentation, high-pressure thermogravimetry will be introduced as a novel and versatile analytical method for developing, parameter optimization and scaling of pyrolysis and gasification of organic materials. These processes are used to break down an end-of-life product into its molecular components at high temperatures, often at elevated pressure, and possibly using a gasification agent. Depending on the process parameters and method, various hydrocarbon-containing synthesis gases are produced from the material. These are fed back into the chemical value chain as raw materials and can thus also be used for virgin polymer production from recycled feedstock.

In the presentation, case studies will be used to demonstrate how high-pressure thermogravimetry combined with decomposition product gas analysis enables the development of chemical recycling processes on the laboratory scale. Since these laboratory analyses are performed under real process conditions, the results can be directly transferred to industrial scale. Thus, the parameters of industrial processes can be optimized to increase the yield and the process can be adopted to produce the desired synthesis gas using changing residual materials.