

## **Investigation of the Pyrolysis of Rigid Polyurethane Foam as a Possibility for Chemical Recycling**

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### **Abstract**

The chemical and plastics industry faces the challenge of increased recycling and reuse of the carbon in plastic products. Plastic waste that is not suitable for higher-value mechanical or chemical recycling through depolymerisation could be converted into valuable compounds such as their monomers or chemically related compounds through pyrolysis. These plastics include rigid polyurethane foams, which are used, for example, as insulation in the building sector or in refrigerators.

In this project, the principle possibility of recycling rigid polyurethane foam using pyrolysis was investigated. With these experiments, it was first determined which products and by-products can be created under ideal conditions with or without catalysts. The investigations took place in two steps: In a first step, hyphenated high-resolution instrumental-analytical methods were used to develop an understanding of the thermally induced chemical reactions of a PU rigid foam at the molecular level. Thermogravimetric infrared spectroscopy (TG-IR) was used to determine the thermal decomposition behaviour and to assign chemical structural elements to the volatile pyrolysis products. Subsequently, pyrolysis experiments were carried out with the direct hyphenation of analytical pyrolysis with comprehensive gas chromatography and mass spectrometry (py-GCxGC-MS) to obtain detailed structural information. In a second step, experiments on the pyrolysis of PU rigid foam were carried out under pilot plant scale conditions and the yields and compositions of the products were determined.