

## **CARBONTRANS – A Concept for Chemical Recycling of Carbonaceous Wastes**

D. Klinger\*, M. Friedemann\*/\*\*, B. Meyer\*/\*\*

\*Fraunhofer-Institute for Microstructure of Materials and Systems, \*\*Technische Universität Bergakademie Freiberg, Germany

### **Abstract**

255 Mio. of carbonaceous wastes are burned worldwide and contribute to global THG emissions. But, carbonaceous wastes and residues could be an alternative source for chemical and petrochemical processes to generate high value products and can therefore lead to a circular carbon economy. Changing regulatory framework e. g. for packaging plastics, bad image of plastic products due to environmental pollution (ocean waste, micro plastic discussion) and the higher awareness of consumers to use “green” or recycled products spotlight chemical recycling technologies for R&D institutions as well as industry.

The presented concept for chemical recycling is based on gasification as interface technology, means the conversion of carbonaceous wastes into synthesis gas, which can be further used to produce several chemical products. The concept is focused on waste streams, which cannot be recycled mechanically or with other chemical processes to produce high value products. To reduce process related CO<sub>2</sub> emissions due to autothermal heat supply in the future, renewable hydrogen from electrolysis can be integrated in the process chain. The concept interconnect the sectors waste management, energy management, plant engineering and construction as well as chemical industry (sector coupling). Hence, all relevant actors across the value chain are incorporated.

Waste gasification is not a completely new technology in Germany. During the 1990s and 2000s co-gasification plants for brown coal and waste were operated in Berrenrath near Cologne (HTW gasification, Rheinbraun AG) as well as in Schwarze Pumpe (BGL gasification) to produce methanol. Changing regulatory framework leads to revisit the developments in an international context (e.g. Enerkem in Canada, Showa Denko in Japan).

Group Circular Carbon Technologies from Fraunhofer IMWS in Freiberg and Institute of Energy Process Engineering and Chemical Engineering at TU Bergakademie Freiberg are going to improve a fixed bed slagging gasifier, so called FlexiSlag technology, for effective mono waste gasification and a flexible feed portfolio. Successful test campaigns with waste plastic pellets in a 10 MW<sub>th</sub> pilot plant in Freiberg were already done. During a research project modified gasifier will be built up and tested for different waste streams. Afterwards the demonstration of the technology is planned by building Fraunhofer pilot plant Carbontrans (3 t/h, 20 bar) in Leuna, where it will be completely integrated in the chemical site.

The presentation will show the concept for a circular carbon economy by using waste gasification as an interface technology, give a status quo for waste gasification technologies as well as the results of the test runs with waste plastics in the pilot plant in Freiberg. Furthermore, the status of the planning of Fraunhofer Pilot plant Carbontrans and an outline for the next development steps will be presented.