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Abstract

Over the last century there has been a global interest in reducing/recycling waste material as well as creating energy from renewable and more eco-friendly sources. Catalytic gasification is one effective method that can promote low-temperature conversion of solid waste to energy, also referred to as "gasification". The gas mixture produced by gasification of long-chain polymers using ruthenium (or platinum) catalysts consists of hydrogen, methane, carbon monoxide, carbon dioxide, and water.

Product mixtures of gasification experiments were analyzed by Gas Chromatography (GC) and post-processed using statistical analysis. Using fundamental reactor design equations along with stoichiometric calculations yielded the percent gasified as well as the reaction selectivity of the process.

The solid residues containing ashes, char, ruthenium, and polyethylene unreacted were analyzed in a Differential Scanning Calorimetry (DSC) and a Scanning Electron Microscope (SEM) to identify its components. Quantification of the DSC spectra was used to correlate the thermal characterization of the residues with the unconverted (or non-gasified) after the reaction was quenched. Lastly, the SEM provided information on the microstructure of the residues, their atomic composition, and preliminary assessment of the possibility of catalyst recovery.

These results are next to be used in formulating a kinetic mechanism for the liquid-phase oxidation, and thus complete a model of catalytic gasification amenable for scaling-up the process to continuous operation.