

on

100% renewable resource-based Polyethylene Furanoate (PEF) as a “green” Alternative to PET

Motivation

Towards a more sustainable future, polyethylene furanoate (PEF) represents a 100% renewable resource-based alternative to polyethylene terephthalate (PET), which is at an annual production of 50M T/a one of the most dominant plastics on the planet. Polyethylene furanoate (PEF) has already shown to possess superior material properties to PET, which allows not only for a reduction in carbon footprint, but also for improved products in typical PET applications such as food packaging, textiles, car tyres, medical devices, solar cells etc. While recent efforts in industry and academia were focused on synthesis of PEF via polycondensation, which is a step-growth polymerization burdened with by-product removal and long reaction times (days), we are exploring a novel route: Ring-opening polymerization (ROP) of cyclic PEF monomers which do not feature endgroups that have to be removed. This approach offers fast reaction times (minutes) and a better control of (co)polymer architecture through a “living” process.

Your Work

In order to establish an industrially competitive process (envisioned scheme outlined below) and PEF as a superior material, the following tasks have to be addressed:

- 1) Optimization of reaction conditions such as temperature and catalyst type to achieve high molecular weight PEF at full conversions
- 2) Scale-up of the reaction from lab- to pilot-scale in cooperation with our industrial collaborator SULZER ChemTech in Winterthur, application and development of a kinetic computer model
- 3) Material engineering using high-quality PEF: investigate properties of PEF applications (bottles, coatings, functionalizations, copolymers, etc)

This project will teach you deeper insights into polymer synthesis, “green” process development and principles of chemical engineering. Your work will also be valuable for patenting and publications. If this project excites you, join the PEF crew!

