LABORATORY FOR CHEMICAL TECHNOLOGY
Technologiepark 125, 9052 Gent, Belgium

Coach	Supervisor	Funding
Ling Feng Li Dr. Hari Sekhar Mitta	Prof. Kevin Van Geem	CYCLOPS

Single atoms anchored on porous Nitrogen-doped Carbon materials (SAPNC)

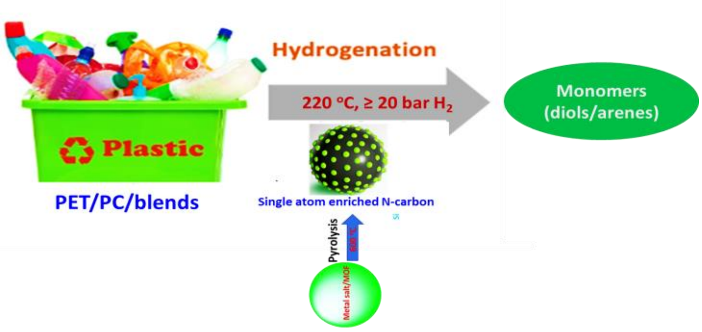
Aim

Tuning non-noble nanoparticle in a carbon matrix for efficient and selective hydrogenation of oxygenates polymers

Justification

Plastics are widely used and have been ingrained in the day-to-day life of modern society. There has been an increase in the annual demand for plastics during the past few decades due to the ever-increasing dependence on different materials, such as food packaging, hardware, electronics, and construction. Since plastic waste can partially degrade into microplastics, these are highly harmful to the environment. Correctly disposing of plastic waste is a major issue today. This situation could be addressed by developing depolymerization techniques that can convert waste plastic into useful monomers. Recent years have seen an increase in the use of noble homogenous catalysts for catalytic reductive depolymerization of waste plastics. It is still a challenge for scientists to determine how to distinguish noble metal catalysts from products, as well as to ensure their stability and long-term usability. This necessitates the design and synthesis of a non-noble metal catalyst that has low cost, high activity, high stability for the hydrogenolysis of oxygenates polymers (PET/PC/blends) at high pressure (harsh conditions, ≥ 30bar) (as illustrated in scheme1).

Single-atom catalysts (SAC) have received a lot of attention recently in the field of heterogeneous catalysis due to their potential to stabilize metal nanoparticles, by modifying their electrical and geometric structures, and improve the catalytic efficiency. However, reactants can access each metal atoms. The characterization and preparation of SACs is challenging due to it was unclear for a long time whether SACs could be experimentally attainable, catalytically active, or stable in chemical processes. Researchers have used a range of strategies to solve the issue of metal nanoparticle stability, including the choice of a suitable carrier (such as Fe_2O_3, CeO_2, and TiO_2), the encapsulation of metal particles in carbon and nitrogen molecules, and a variety of single-atom MOF catalysts. This project specifically focused on the development of single atom encapsulated porous carbon/nitrogen pyrolysis at 600-700 ºC for 3-4h under nitrogen atmosphere. The developed catalysts will be characterized for identification of their physicochemical properties by using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), SEM and, (BET-surface/Pore volume-pore diameters, and acidity/basicity/reduction).



Scheme 1. Reaction schematic procedure

Objects of the project:

The activities to be specified below.

- State-of-the art report on SACs
- Catalyst synthesis and characterizations
- The screening of catalysts recipes for hydrogenolysis of PET/PC/blends at high pressure batch reactor (PARR)
- Optimize the process parameters
- The submission after evaluation of the draft completion report

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