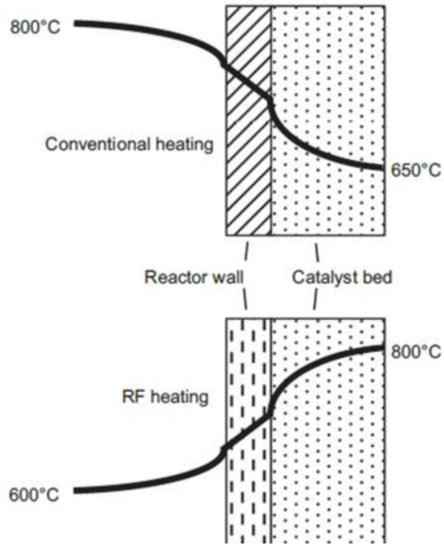
Development of novel selective oxidation reactions under an applied magnetic field.

Background

In this project, we intend to explore an exciting application of magnetic materials in heterogeneous catalysis. Magnetic materials, when under an applied magnetic field, generate heat at the surface of the material due to the Neel effect. It is hoped that this effect can be exploited and applied to the synthesis of important chemical intermediates in a micro trickle reactor that has recently been setup at the Chalmers University of Technology

This project intends to develop novel, green reactions using an applied magnetic field that can contribute to a sustainable chemical future. However, major challenges need to be investigated, such as development of efficient and earth abundant catalytic materials, high activity and selectivity preferably at low temperatures and pressures, and efficient use of the atoms in the reactant molecule, namely minimizing waste and by-product formation, to mention a few.



Project objectives

The initial outlay of this project will involve the synthesis of doped iron oxide nanoparticles using several selected methodologies. A range of dopants will be selected that will help control either the magnetic or catalytic properties of the materials. These materials will concurrently be applied to a few nominated selective oxidation reactions of important chemical intermediates such as styrene, toluene using either oxygen or hydrogen peroxide as the source of active oxygen. Input from the participating student on the direction of this project will be actively encouraged.

This is a collaborative project between Professor Hanna Härelind and Assistant. Professor Sundén

Learning objectives

- Literature overview of potential catalytic materials
- Design, preparation and characterisation of novel doped magnetic materials
    - Particle size and morphology by transmission electron microscopy (TEM)
    - Surface composition by X-ray photoelectron spectroscopy (XPS)
    - Elemental composition by X-Ray fluorescence (XRF)
    - Total surface area by nitrogen storage (BET)
    - Magnetic measurements
- Evaluation of the catalytic material in laboratory micro reactor using inductive heating
    - Qualitative and quantitative analysis by GCMS and GCFID
- Oral and written presentation (master thesis) of the project results

Contacts

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