Magnetocaloric Metal-oxides for Efficient H_2 Liquefaction

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Related projects: HYDROGENi

Research interests: energy materials, structural characterization and optimization, hydrogen liquefaction, magnetocaloric materials

Background: Nanoscience and materials chemistry

Introduction

- Storage and transportation of H_2 are key challenges in the hydrogen value chain.
- Liquefaction by cooling down to 20 K (-253 °C) is a promising solution, but highly energy intensive with today's technology.
- Magnetocaloric cooling uses magnetic materials and strong magnetic fields to achieve an up to 50 % higher energy efficiency.

Primary objective:

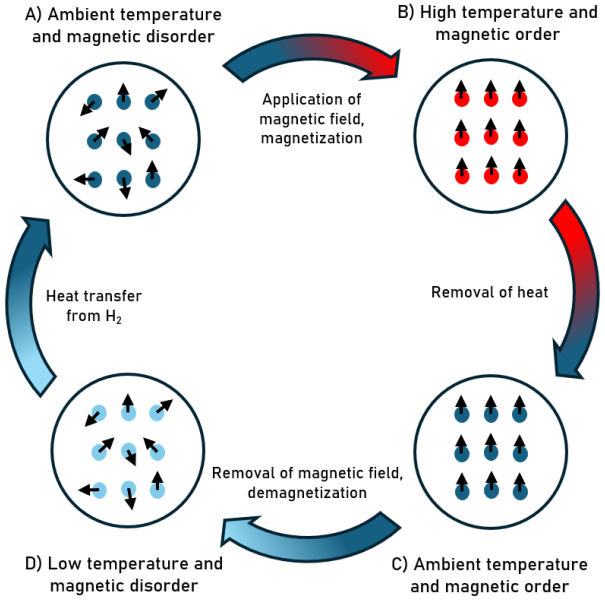
To identify and optimize promising materials for magnetocaloric H_2 liquefaction

Secondary objectives:

- Identify design principles for magnetocaloric materials
- Find viable and scalable production methods

Magnetocaloric cooling principles

- Transitions between ordered and disordered magnetic states are used to store potential/thermal energy
- Application or removal of an external magnetic field is used to trigger these transitions, leading to cooling or heating of the material.



Estimated progress of the PhD project:

Just started ...	< 50 %	> 50 %	Almost done ☺

Project future

- Varying composition and structural defects:
  - Optimize the cooling temperature range
  - Maximize cooling effect (J/kg)

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