EM PI REAKTIVE FLUIDE
Institut für Energie- und Material-Prozesse

UNIVERSITÄT DUISBURG ESSEN
Offen im Denken

Master / Bachelor thesis

"Investigations into the Spray Flame Synthesis of Doped $LaMnO_3$-Based Nanoparticles for Magnetocaloric Applications"

Background and Description

Magnetocaloric materials are promising candidates for energy-efficient solid-state cooling technologies. Among them, doped $LaMnO_3$ perovskites have attracted significant interest due to their compositional tunability, chemical stability, and magnetically active behavior. Spray flame synthesis (SFS) is a powerful single-step method for producing oxide nanoparticles with high purity and compositional control. However, $LaMnO_3$ based nanoparticles synthesized via SFS typically form very small particles that often exhibit superparamagnetic behavior, which can influence their magnetic properties.

Understanding how synthesis parameters such as precursor chemistry, solvent composition, and flame conditions affect particle size and phase formation is therefore essential. This thesis focuses on systematically investigating the spray flame synthesis of doped $LaMnO_3$ nanoparticles and characterizing their resulting properties.

Aim of the Thesis

This thesis aims to investigate the synthesis of doped $LaMnO_3$ nanoparticles using spray flame synthesis and to study how precursor formulation, solvent choice, and flame parameters influence particle formation, its size, and crystal structure. The work will explore whether synthesis conditions can be adjusted to promote particle growth during flame processing and how these changes affect the suitability of the materials for magnetocaloric-related applications.

Tasks

- Familiarization with spray flame synthesis for oxide nanoparticle production
- Systematic variation of solvent, precursor and flame parameters
- Structural, chemical and optical characterization (TEM/EDX, XRD, UV–Vis's reflectance, FTIR)
- Correlation of synthesis parameters with particle size and phase composition

Requirements

- Interest in nanoparticle synthesis and materials chemistry
- Basic knowledge of nanoparticle characterization techniques
- Interest in magnetic materials and functional oxides
- Motivation to work experimentally in a laboratory environment

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