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TECHNISCHE UNIVERSITÄT DARMSTADT

FUNKTIONALE MATERIALIEN

Advanced Research Lab/Bachelor thesis

Magnetic Assembly of Magnetic Nanoparticles into Nanochains

Superparamagnetic iron oxide nanoparticles have been widely studied for possible biomedical applications for both therapeutic and diagnostic purposes. Recent studies have demonstrated that the guided assembly of these nanoparticles into anisotropic structures, such as nano-chains, significantly enhances their selective accumulation in cancer cells compared to spherical nanoparticles. This suggests that the shape and geometry of nanoparticles play a crucial role in cell-type selective intracellular uptake and accumulation [1]. The goal of this work is to synthesize and compare magnetic nano-chain nanoparticles using a magnetic field-guided interface co-assembly method [2]. In this process, magnetic nanoparticles will be magnetically assembled into nano-chains and stabilized by coating them with a silica layer to maintain their structure when the magnetic field is removed. The length of the synthesized nano-chains will be controlled by adjusting the exposure duration of the reaction mixture to the magnetic field. This study aims to explore the potential of these nano-chains in biomedical applications, particularly in enhancing magnetic fluid hyperthermia for cancer therapy.

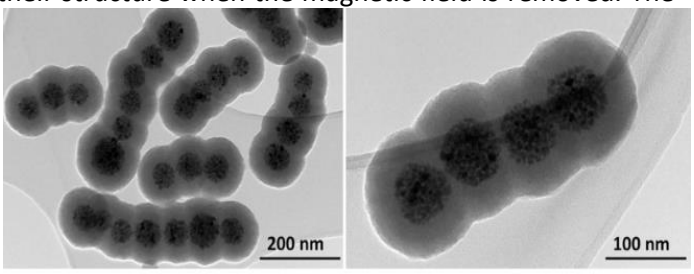

Figure 1 TEM images showing the magnetic nano chains prepared by facile sol-gel synthesis in a magnetic field [1]

Reference:

[1]DOI: 10.1039/D2NR06965B (Communication) Nanoscale, 2023
[2] doi.org/10.1021/acsnano.5b02328 ACS Nano. 2015

Expertise to be gained:

- Learning about **magnetic nanoparticles for biomedical applications**.
- Nanomaterials synthesis and surface coating →**wet chemistry and magnetic assembly**
- Structural analysis → **X-ray powder diffraction**
- Microstructure analysis → **Transmission electron microscopy TEM**
- Magnetic characterization → **SQUID magnetometer.**
- Magnetic hyperthermia characterization → **AC calorimetry**

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