LABORATORY OF BIOPHYSICS

WAGENINGEN UNIVERSITY & RESEARCH

Microsensors for microflow-MRI at ultra-high magnetic fields

Magnetic resonance imaging (MRI) is a powerful and non-invasive technique for examining complex materials and living organisms, including the whole human body. The notorious problem of MRI instrumentation is low signal intensity that largely limits the range of possible applications. In our team we develop highly-sensitive microsensors for imaging microflow of multi-phase structured liquids used in, e.g., food or cosmetic industry, as well as biological tissues ranging from cardiac patches to meat replacements.

Such sensors combined with NMR spectrometers operating at ultra-high magnetic fields from 14 T up to 28 T will enable us to acquire MRI scans within seconds or minutes instead of typically hours or days, all while keeping the highest spatial resolution up to 10 μm. The figures below graphically outline the scope of our studies within this project.

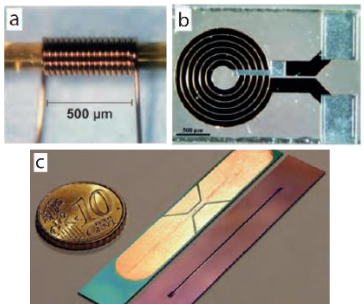

Fig. 1. Optimizing microsensors for MRI: which is best?

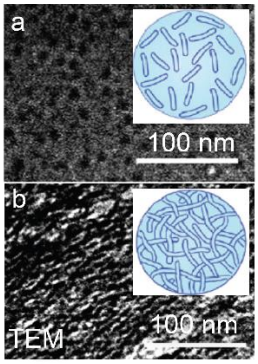

Fig. 2. Smart materials: wormlike micelles change structure under flow.

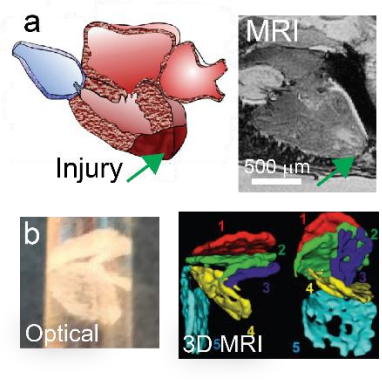

Fig. 3. MRI of healing tissues: (a) injured fish heart; (b) patches for heart surgery.

We are looking for **BSc** and **MSc thesis** students for:

1. Designing and testing microsensors with outstanding sensitivity for fast microflow MRI and on-line microscopy; see Fig. 1.
2. Developing and advancing measurement MRI techniques at ultrahigh magnetic fields for: (i) flow measurements of complex fluids and smart materials (e.g. Fig. 2); (ii) pre-clinical studies of regenerative processes in biological tissues; see Fig. 3.

A chosen topic will be conducted under appropriate training in instruments operation and data analysis tools. The project offers direct exposure to our Dutch NMR consortium, as well as further opportunities for internships.

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