Contribution ID: **35** Type: **Talk (20 min + 5 min discussion)**

HYMN –A novel unified toolbox for in-situ magnetic hyperthermia experiments using neutron scattering

Monday, 4 December 2023 15:50 (25 minutes)

One of the most promising use cases of magnetic hyperthermia is using magnetic nanoparticles (MNPs) for cancer therapy. In this treatment, MNPs are immersed into tumours and, by heating with external magnetic fields, typically 100-900 kHz, destroy cancer cells. For a successful application, the heating power needs to be improved by optimising the MNP structure. Recent studies have also shown a significant increase in magnetic heating by exciting the transversal spin modes in MNPs in the low GHz range. An ideal tool for characterising such MNPs is small-angle neutron scattering (SANS). Our ERUM-Pro HYMN project aims to develop a novel, unified experimental and computational toolbox for in-situ magnetic hyperthermia experiments under clinical conditions, utilising the SANS and MIEZE-SANS, combined with nanomagnetic simulations. This will be achieved by developing two setups for operation in the 100-450 kHz (up to 20 mT) and 0.5-4 GHz (up to 2 mT) range. We present the first SANS and SAXS results, where we used in-situ RF heating at up to 360 kHz to examine the dynamic structure formation of magnetite nanocubes with 12, 33, 35 and 53 nm sizes in water solutions. Our observations indicate the development of 1D and 2D structures, with significant variations linked to the field parameters and MNP sizes. We are currently conducting ongoing Reverse Monte Carlo simulations to further refine our interpretation of the obtained data.

Primary author: DEMBSKI-VILLALTA, Michal

Co-authors: JOCHUM, Johanna K.; ROCHELS, Leonhard (Universität Duisburg-Essen); BENDER, Philipp; DISCH, Sabrina (Universität Duisburg-Essen); MUEHLBAUER, Sebastian

Presenter: DEMBSKI-VILLALTA, Michal

Session Classification: Neutron Methods

Track Classification: Neutron Methods