

## **Large-Scale Production of High-Quality Magnetic Nanoparticles: Linking Material Design to Hyperthermia and MPI Imaging Capabilities – Abstract**

Magnetic nanoparticles (MNPs) are enabling powerful biomedical technologies, from minimally invasive cancer therapies based on magnetic hyperthermia to next-generation diagnostic tools such as Magnetic Particle Imaging (MPI) and other recent non-biomedical applications. Yet, a major barrier preventing their broader impact is the difficulty of producing high-quality MNPs at large scale while preserving precise control over size, shape, magnetic anisotropy, and colloidal stability, all key parameters that determine heating performance and MPI signal.

In this webinar, I will present scalable synthetic strategies to produce magnetic nanoparticles with controlled morphology and superior magnetic properties, highlighting how design and process optimization at the gram scale can achieve reproducibility without compromising performance. I will discuss the relationship between synthesis conditions and magnetic behavior, linking structural descriptors (shape, composition, agglomeration state) to functional outputs such as SAR (Specific Absorption Rate) and MPI signals. Examples will include high-quality nanocubes and other shapes that simultaneously maximize heating efficiency and MPI sensitivity, enabling dual theranostic applications.