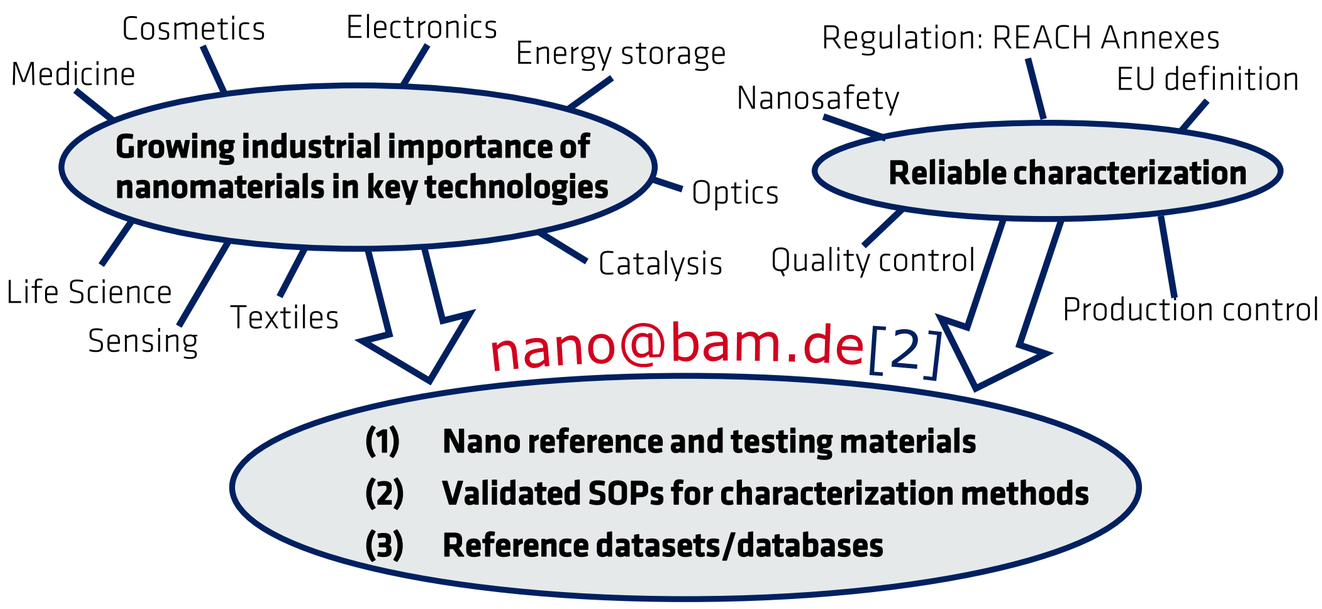
Fine iron oxide nanoparticles as a candidate reference material for reliable measurement of particle size

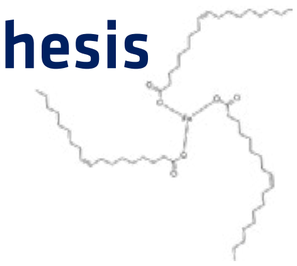
P. Mrkwitschka [1] *, S.-L. Abram [1] *, P. Kuchenbecker [1], C. Würth [1], B. Rühle [1], U. Resch-Genger [1] and V.-D. Hodoroaba [1]

[1] Bundesanstalt für Materialforschung und –prüfung, *equal contributors

Iron oxide nanoparticles are studied for their potential use as reference nanomaterials for imaging techniques. An extensive assessment of the particle size and size distribution has been achieved by means of SEM, TEM, DLS and AFM. Preliminary results show a promising candidate material of well defined shape and size in the range of 10 nm. Iron oxide as a reference nanomaterial could expand the scarce list of worldwide available nanoparticles[1] and complement the available spherical Au and silica particles. The presented nanoparticles offer interesting properties in imaging applications. Noteworthy, the sample preparation for imaging on suitable substrates is very user friendly.

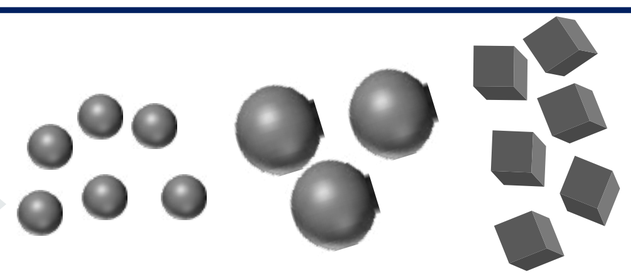


Synthesis

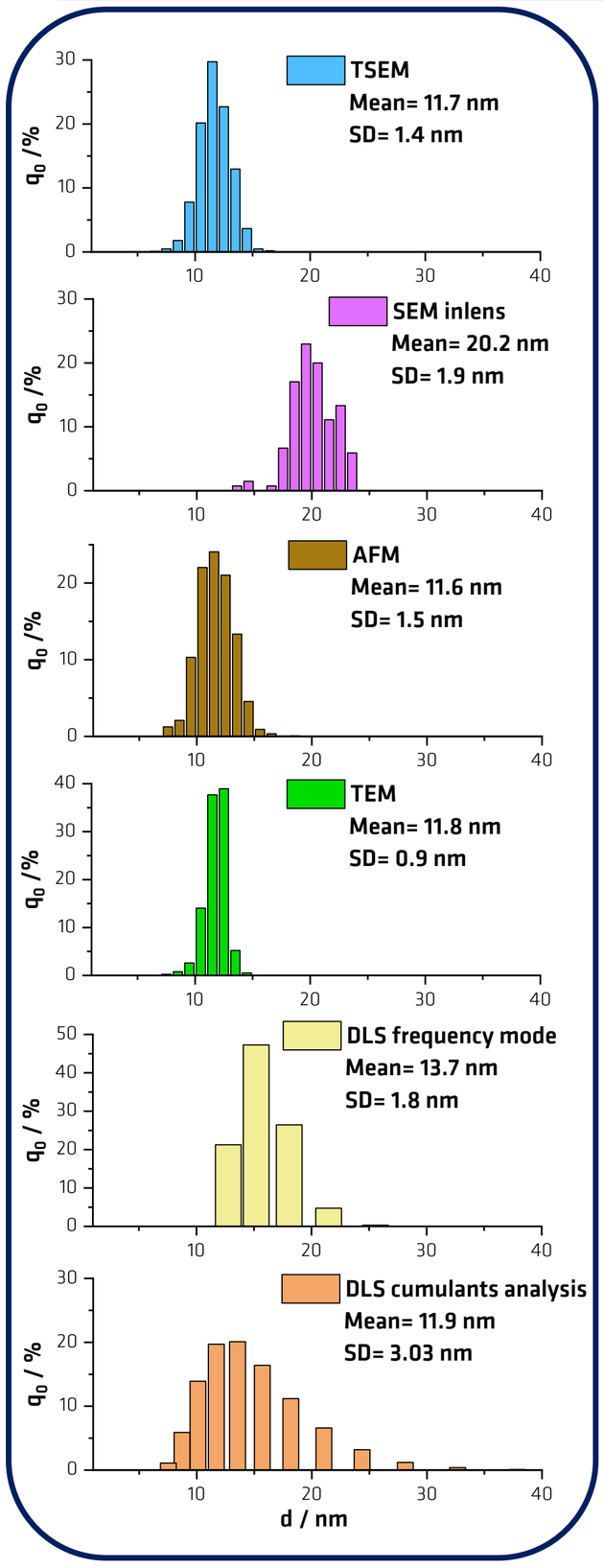


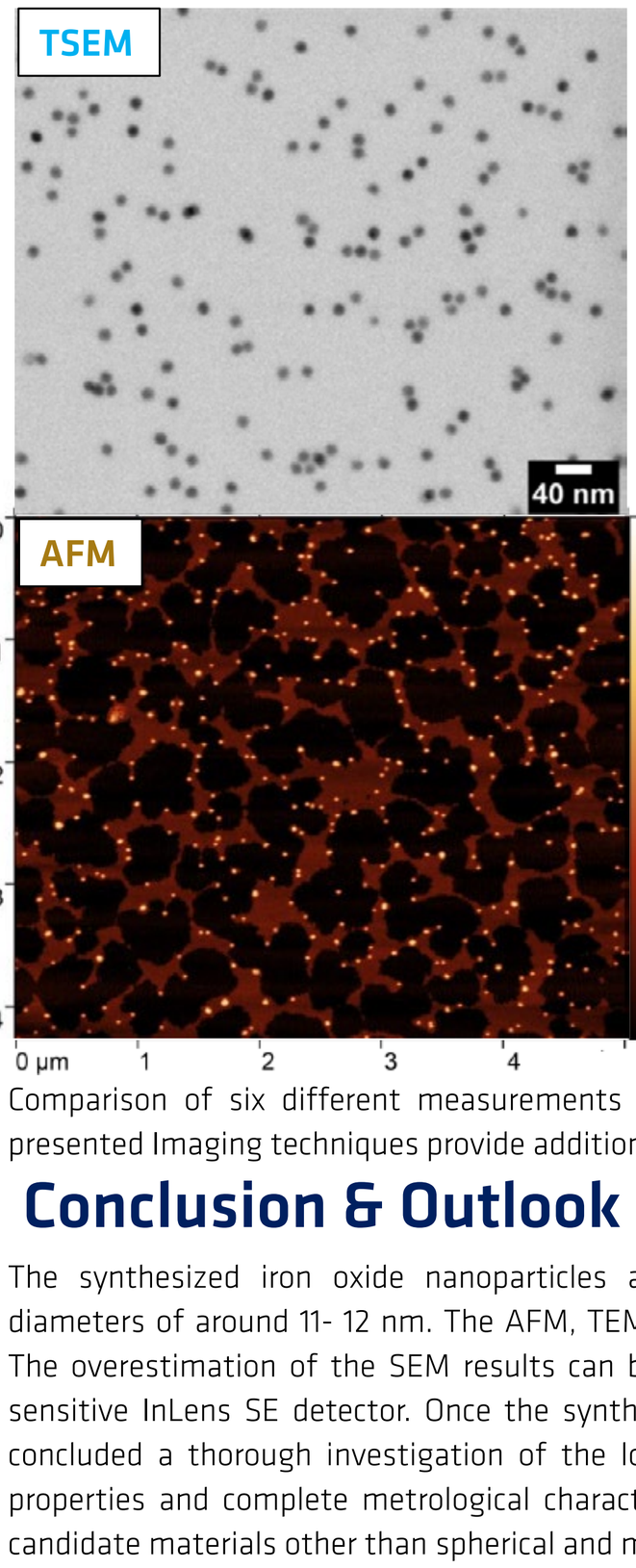
thermal decomposition of iron(III) fatty acids [3]

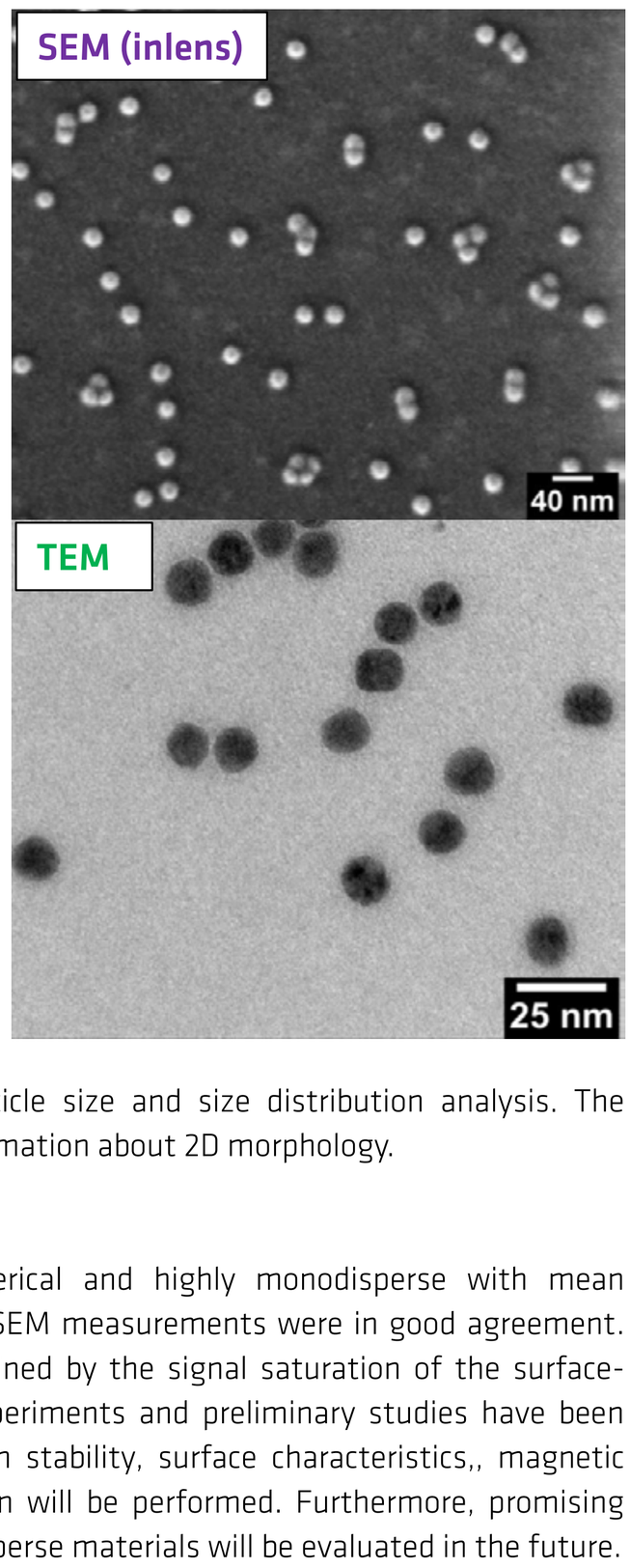
- T, t
- Solvents
- Ligands



- Monodisperse particles
- High yields
- gram scale
- Size control
- Shape control







Comparison of six different measurements for particle size and size distribution analysis. The presented Imaging techniques provide additional information about 2D morphology.

Conclusion & Outlook

The synthesized iron oxide nanoparticles are spherical and highly monodisperse with mean diameters of around 11- 12 nm. The AFM, TEM and TSEM measurements were in good agreement. The overestimation of the SEM results can be explained by the signal saturation of the surface-sensitive InLens SE detector. Once the synthesis experiments and preliminary studies have been concluded a thorough investigation of the long term stability, surface characteristics,, magnetic properties and complete metrological characterization will be performed. Furthermore, promising candidate materials other than spherical and monodisperse materials will be evaluated in the future.

Literature

[1] Thünemann A. F., Emmerling F. and Hodoroaba V.-D.: Review of existing calibration or reference materials, NanoDefine Technical Report D1.1, NanoDefine Consortium, Wageningen, 2014

[2] https://www.bam.de/Navigation/EN/Topics/Materials/Nanotechnology/nanotechnology.html

[3] doi:10.1038/nmat125110.1021/ja0692478

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