

5.5 nm dN5

MAGNETIC NANOPARTICLES



DESCRIPTION

Product name: dN5

Material composition: Highly crystalline iron oxide magnetic nanoparticles of maghemite crystalline phase (Fe_2O_3), with monomodal and narrow particle size distribution; 5.5 nm mean size, < 10% dispersion).

Available Solvents: Nanoparticles can be stabilized in aqueous and organic solvent colloidal dispersions:

1. Aqueous dispersions.

Nanoparticles electrostatically stabilized with tetramethylammonium hydroxide (TMAOH; pH = 13) or dimercaptosuccinic acid (DMSA; pH = 7).

2. Organic solvent dispersions.

Nanoparticles sterically stabilized with oleic acid in low boiling point solvents (hexane, toluene, chloroform) or in high boiling point solvents (long-chain aliphatic hydrocarbons, long-chain amines, long-chain ethers).

Synthesis: Proprietary synthetic method developed and registered by das-Nano. This method ensures the reproducibility of the synthesized nanoparticles in terms of particle shape, size and particle size distribution.

Stability: highly-stable colloidal dispersions over time (minimum 7 months). Checked with magnetometry a minimum stability of 7 months after storage under air at RT (see section 2.3 MAGNETIC MEASUREMENTS).

Storage: 4-25°C (do not freeze)

Main physicochemical properties:

- ✓ Crystalline phase (determined by Fe-XANES spectroscopy): maghemite (Fe_2O_3).
- ✓ Particle shape (determined by transmission electron microscopy (TEM)): spherical/spheroid.

✓ Particle size (determined by TEM (over 2.000 counts)): 5.5 nm

✓ Surfactant / solvent composition:

- Aqueous dispersions: tetramethylammonium hydroxide (TMAOH) / water or dimercaptosuccinic acid (DMSA) / water

- Organic solvent: oleic acid / low boiling point solvents (hexane, toluene, chloroform) or high boiling point solvents (long-chain aliphatic hydrocarbons, long-chain amines, long-chain ethers)

✓ Concentration: 10 mg Fe_3O_4 /ml

✓ Saturation magnetization: 51 emu/g Fe_3O_4

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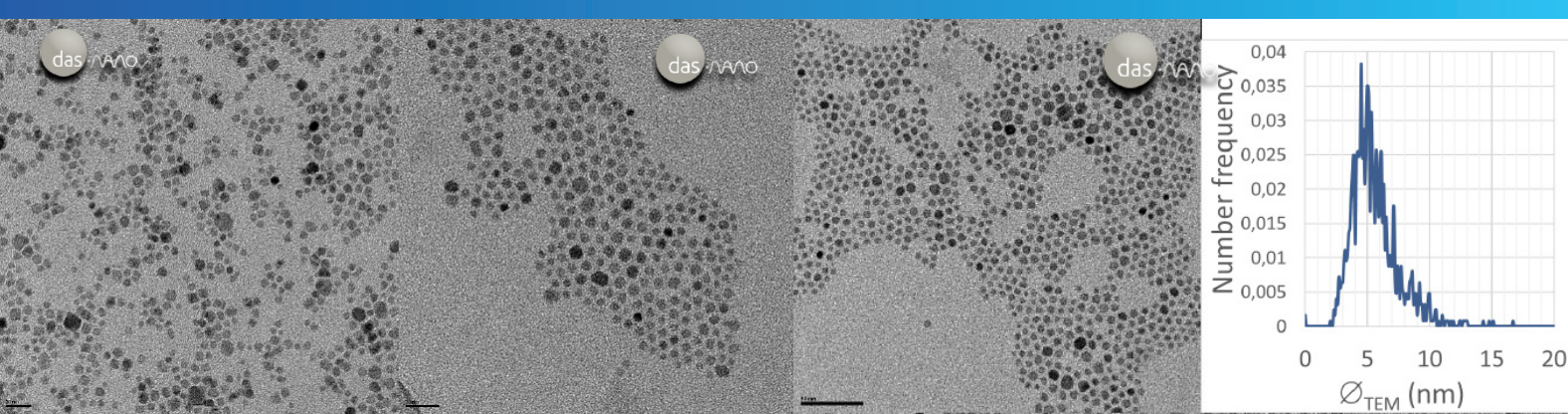


FIGURE 1. TEM IMAGES OF MAGHEMITE NANOPARTICLES. SCALE BARS: 20 NM (LOWER IMAGES) AND 50 NM (UPPER IMAGE). UPPER GRAPH: PARTICLE DIAMETER DISTRIBUTION DETERMINED BY TEM.

CHARACTERIZATION

TRANSMISSION ELECTRON MICROSCOPY (TEM)

Maghemite nanoparticles are homogeneous in shape and size (Figure 1).

Mean particle size: 5.5 nm.

IRON X-RAY ABSORPTION NEAR EDGE STRUCTURE (FE-XANES)

Crystalline phase was analysed by Fe-XANES in the European Synchrotron Radiation Facility, in Grenoble. The crystalline phase of the material is maghemite, after comparing its spectrum with reference spectra of magnetite (Fe_3O_4) and maghemite (Fe_2O_3) (Figure 2).

MAGNETIC MEASUREMENTS

The material is monomodal and superparamagnetic at room temperature.

Blocking temperature: 16 ± 2 K.
Saturation magnetization: 60 emu/g Fe_2O_3 .

The magnetization is stable for at least 7 months, after storage under air at RT (Figure 3).

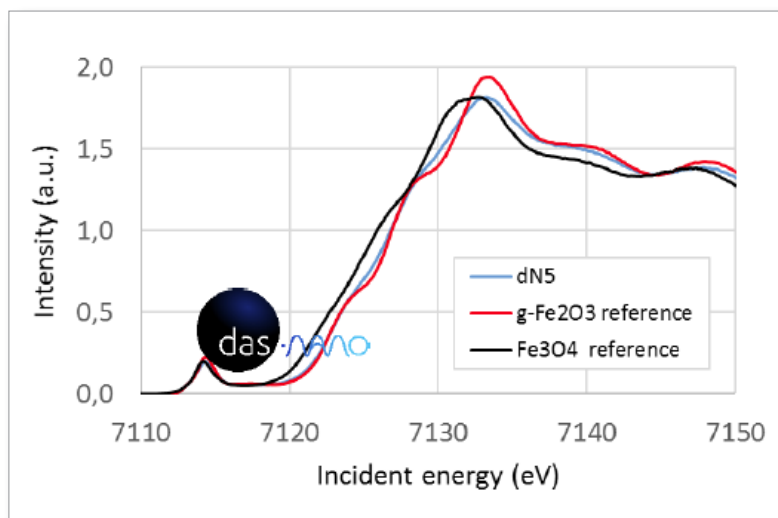


FIGURE 2. FE-XANES SPECTRUM OF DN5 MATERIAL

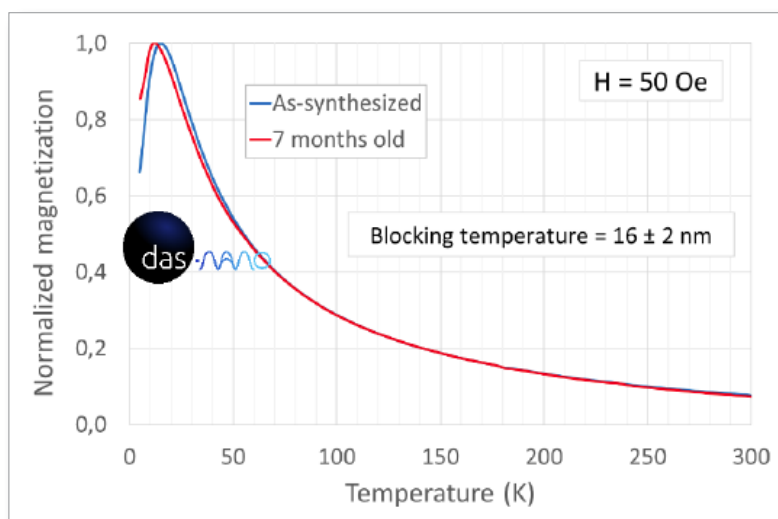


FIGURE 3. ZFC CURVE OF ONE REPRESENTATIVE SAMPLE

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