

Metallic Co, Fe, and Fe/Co-Alloy Magnetic Fluids for Technical Applications

H. Bönnemann^{a,c}, S. Behrens^a, E. Dinjus^{a,b}, N. Matoussevitch^{a,b}

^a Forschungszentrum Karlsruhe, ITC-CPV, Post Box 3640, D-76021 Karlsruhe, Germany,

^b University of Heidelberg, D-69117 Heidelberg, Germany

^c Max-Planck-Institut für Kohlenforschung, Kaiser-Wilhelm-Platz 1, D-45470 Mülheim, Germany,

The properties of magnetic fluids (MF) must individually be tailored for each concrete application in technical or biomedical systems. High vacuum seals, bearings, brakes, dampers, and a number of similar technical equipments need long-term stable magnetic fluids with high saturation magnetisation and low viscosity. To reach these technical requirements metallic and bi-metallic MF's based on mineral-, vacuum-, and silicon-oils are most promising. For medical and biomedical applications, in contrast, water-based MF's are needed.

During the last few years our focus was to develop novel Co-, Fe-, and Fe/Co-particles which are monodisperse (ca. 10 nm), air-stable, and dispersible in a plethora of carrier-liquids including water to give stable magnetic fluids which meet the above mentioned requirements. We have introduced the synthesis of metallic nanoparticles via the controlled thermolysis (or co-thermolysis) of the corresponding metal carbonyls in the presence of aluminium alkyls.

We also develop the method to obtaining the large than 10nm metallic particles.

The anticorrosive stabilisation is brought about by so called "smooth oxidation" of the metallic surface [1]

The peptisation of these metallic or bi-metallic magnetic nanoparticles (Fe, Co, and Fe/Co) to give MF's in different carrier liquids was investigated by using suitable surfactants. The resulting MF's show high saturation magnetisation at low metal concentrations (see Table).

The fluids were successfully tested for different technical applications, such as brakes (W. Patzwaldt, Physiklabor, Reutlingen), positioning systems (N. Bayat,

TU-Berlin), magnetic pumps (R. Krauß, Uni-Bayreuth), and other systems.

Table of metallic MFs in organic media

Metal	Media	Vol.conc. [%]	Magnetization M_s [kA/m] / [mT]
Co	WT12	10.41	152.,1 / 191.2
Co	AP 201	8.91	130.3 / 163.8
Co	kerosene	8.54	125 / 157
Co	kerosene	8.21	120 / 144.4
Co	L9	5.21	73.,52 / 88.22
Fe/Co	kerosene	2.81	67.32 / 84.60
Co	DC702	4.4	64.2 / 80.4
Fe/Co	WT12	2.51	58.3 / 70
Fe	kerosene	1.38	24.02 / 30.18

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References

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