Airstable Cobalt-, Iron-, and Iron/Cobalt Nanocolloids and Ferrofluids

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A size-selective synthesis of Co-, Fe/Co-alloy, and Fe-nanoparticles via the decomposition of low valent carbonyl complexes of the respective transition metals in the presence of aluminum-organic compounds will be discussed. In case of the system Co/$Al(oct)_3$ monodisperse particles of 10 ± 1,3 nm are formed. Subsequent "smooth oxidation" leads to the formation of an oxidic "protecting shell" around the metallic core resulting in stable magnetic nanoparticles exhibiting a remarkable long term stability when exposed to normal atmosphere (air and moisture). Experimental evidence for this including XAS, UPS, MIES data and magnetic properties will be presented. This oxidic coat can be modified with a number of surfactants resulting in air stable magnetic fluids. Using appropriate peptization agents magnetic fluids with high magnetic properties (>170 mT) and high volume concentration (e.g. 10Vol Co) were obtained in organic media.

$Fe(CO)_5$ and $Co_2(CO)_8$ are suitable precursors for the aluminum trialkyl mediated synthesis of Fe and Fe/Co nano sized particles, respectively, which may be peptised in organic solvents to give MFs. The particles have a narrow size distribution which can be conserved during the "smooth" oxidation and subsequent peptisation processes. Besides the well-known surfactants as Korantin SH or LP4 natural Cashew Nut Shell Liquid was tested as a novel surfactant.
First results on the peptisation of metallic particles in polar solvents such as alcohol or water for biomedical applications will also be presented [1].

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References

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