Nanotek-2013

OMICS Group Conferences
Accelerating Scientific Discovery

3rd International Conference on
Nanotek & Expo

December 2-4, 2013 Las Vegas, USA

Superparamagnetic particles and their application in water purification and resources recovery

Karl Mandel

Fraunhofer Institute for Silicate Research ISC, Germany

Abstract

Tailored magnetic particles might be promising agents for purification and recovery applications. Such particles may act as scavengers when added to a fluid (such as water) that contains dissolved substances which shall be removed or recovered. After having adsorbed the targets, the particles can be extracted magnetically from the fluid together with their load. Chemical regeneration allows recovery of substances and a reuse of the particles. Although magnetic separation has been known for a long time, nanotechnology introduced a new aspect to the technique: if particles are nano sized, they may behave superparamagnetically, i.e., these particles may serve as switchable magnets. They can be extracted in the gradient of a magnetic field, but without an external magnetic field, they can be easily dispersed in a fluid without any remanent magnetic agglomeration. Although it is very often published that "nanoparticles" are used for separation of target substances, there are doubts if it is really possible to easily magnetically extract individual nanoparticles as the counteracting Brownian forces are strong for such small particles [1]. It is therefore a better strategy to incorporate many super paramagnetic nanoparticles into a matrix to form larger, micron sized particles, i.e., to transfer the nano property super paramagnetism to the micron scale [2]. Such micron sized switchable magnetic particles can be modified in all kind of ways for (selective) recovery of substances from fluids [2, 3].

[1] K. Mandel, F. Hutter, The magnetic nanoparticle separation problem *Nano Today*, 2012, 7, 485.

[2] K. Mandel, F. Hutter, C. Gellermann, G. Sextl Modified Superparamagnetic Nanocomposite Microparticles for Highly Selective Hg(II) or Cu(II) Separation and Recovery from Aqueous Solutions *ACS Appl. Mater. Interfaces*, 2012, 4, 5633.

[3] K. Mandel, A. Drenkova-Tuhtan, F. Hutter , C. Gellermann, H. Steinmetz, G. Sextl, Layered double hydroxide ion exchangers on super paramagnetic microparticles for recovery of phosphate from waste water *J. Mater. Chem. A*, 2013, 1, 1840.

Biography

KARL MANDEL studied earth science, (nano) materials science and chemistry in Munich, Ulm and Wuerzburg (Germany) as well as at the University of Oxford (UK). He is now working as a scientist at the Fraunhofer Institute for Silicate Research ISC in Wuerzburg, Germany, and is dealing with the synthesis and application of magnetic nanoparticles and nanocomposite microparticles.