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Education

Habilitation in Materials Chemistry (September 1999, INPL Nancy), Ph. D. (July 1992, University of Nancy), Chemical Engineer (June 1989, ECPM Strasbourg)

Academic Carrier

1992 (October) – 2003 (September): CNRS Researcher at the Laboratory of Science and Engineering of Materials of the Mining School of Nancy.

Since 2003 (September): Professor at the University of Strasbourg, European Engineering School in Chemistry, Polymers and Materials (ECPM).
Research at the Institute of Physics and Chemistry of Materials, UMR 7504-CNRS-UdS, 23, rue du Loess, BP43, 67034 Strasbourg Cedex 2.

2005-2009: Head of the « Functional Materials » department at ECPM:

Since 2008: Deputy Director of the European Engineering School in Chemistry, Polymers and Materials (ECPM).

Awards and Honors

October 2001 : Jean Rist Price of the French Society of Metallurgy and Materials (SF2M).

Total Publications

(80 papers), Citation (SCI): 812 (2011, august), h-index: 16

Research Interests

Functionalized iron oxide magnetic nanoparticles (NPs) are intensively studied for biomedical, catalysis and energy applications and are also considered as the building blocks of the future nanotechnological devices. Functionalized iron oxide NPs have attracted an increasing interest as contrast agents for MRI and currently most researches aim at developing multifunctional theranostic (i.e. including therapeutic and diagnostic functions) NPs which can both identify disease states and simultaneously deliver therapy. In the field of spintronic and for magnetic applications, the development of strategies for processing NPs into thin films or into 3D architectures has become a strategic challenge. Multidimensional assembly of magnetic NPs are developped to elaborate many original and significant magnetic and electronic devices. Magnetic NPs have recently gained attention due to their potential use as catalyst supports, providing opportunities for separation of the reaction product and the catalyst. Doped iron oxides are developed as active electrode materials for Li-ion batteries because they are inexpensive and environmentally benign, particularly when compared to other transition metal oxides that are commonly used.
For all these applications, the major steps are the design of the coating, the synthesis and functionalization of magnetic nanoparticles capable of producing highly stable suspensions.

Synthesis and functionalisation of iron oxide nanoparticles for spintronic and biomedical applications

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Functionalized iron oxides nanoparticles are intensively studied for biomedical applications and are also considered as the building blocks of the future nanotechnological devices.
Superparamagnetic iron oxide NPs with appropriate surface coating are widely used for numerous *in vivo* applications and in particular for MRI contrast enhancement. Most studies are performed for improving the materials biocompatibility and ensuring multifunctionalization (targeting, imaging…), but only a few investigations have been carried out improving the quality of the magnetic NPs, their size distribution and studying the effect of their functionalization on their structural and magnetic properties. Indeed particle size, surface chemical structures and the nature of interactions of the organic coating with the NPs surface appear as critical parameters determining the opsonization, biokinetics and biodistribution of magnetic NPs. Therefore, the design of the coating and the nature of the interaction of the coating with the NPs surface are more and more key points to address. In this context, we develop a novel strategy based on the grafting, at the surface of NPs, of small-sized dendritic molecules (favoring the suspensions stability by steric hindrance and constituting a platform for the grafting of functional molecules) via a phosphonate coupling agent (allowing a direct grafting and a stronger binding) [1] in order to develop innovative and competitive contrast agents and theranostic agents.[2]
In the field of spintronic and for magnetic applications, the development of strategies for processing NPs into thin films or into 3D architectures has become a strategic challenge. Multidimensional assembly of magnetic NPs may be used to elaborate many original and significant magnetic and electronic devices. Monodisperse spherically- and cubic-shaped $Fe_{3-x}O_4$ NPs in the range 8-20 nm have been synthesized by thermal decomposition of an iron complex by adjusting synthesis parameters and reactants. Among the different assembling techniques, the Langmuir-Blodgett and the Layer by Layer techniques and the deposition on well-addressed substrates have been investigated. The parameters leading to uniform arrays with a high density and degree of order have been determined for all methods.[3] Then the dipolar interactions in such 2D and 3D arrays have been studied by comparing DC and AC SQUID measurements on powdered NPs, 2D and 3D organized NPs and on diluted NPs. The magneto-transport properties of these NPs have been studied on LB multilayer deposited between two electrodes.[4]

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[3] Pichon, B. P.; Demortière, A.; Pauly, M.; Mougin, K.; Derory, A.; Bégin-Colin, S. *J. Phys. Chem. C* **2010,** *114*, 9041–9048; Pauly, M.; Pichon, B. P.; Albouy, P.-A.; Fleutot, S.; Leuvrey, C.; Trassin, M.; Gallani, J.-L.; Begin-Colin, S. *J. Mater. Chem.* **2011**, DOI: 10.1039/c1jm12012c.; Pichon, B. P.; Louet, P.; Félix, O.; Drillon, M.; Bégin-Colin, S.; Decher, G. *Chem Mater*, **2011**, *23*, 3668-3675.
[4] Pauly, M.; Dayen, J.-F.; Golubev , D.; Beaufrand, J.-B.; Pichon, B. P.; Doudin, B.; Bégin-Colin, S., *Small,* accepted.