EuroSciCon

DAY 1

Keynote Forum

International Conference on

Metal, Mining and Magnetic Materials

November 01-02, 2018 | Paris, France

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Georgi Shpenkov, J Mat. Sci. 2018, Volume:6
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TROUBLE WITH THE ELECTRON SPIN IN THE FIELD OF MAGNETISM

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Spin magnetic moments of electrons play a decisive role in the theory of magnetism. Our research has shown, however, that this is a sad misconception. It turned out that in all cases, physicists deal not with the own (spin) magnetic moments of free electrons, but with the orbital magnetic moments of electrons associated with the atoms. The present report is devoted to the rationale for this discovery. The history of introducing the concept of electron spin is associated with the Einstein-de Haas experiment on the determination of the magneto mechanical ratio (1915). They relied on Bohr's atomic model. From their experiment, it follows that the ratio of the magnetic moment of an orbiting electron to its mechanical moment exceeded in two times the expected (as followed from calculations) value. Calculation of the orbital magnetic moment of an electron in a hydrogen atom was carried out according to a simple formula: where the average value of the electric current is produced by an electron moving in orbit was determined by the formula, as described in all sources, including fundamental university textbooks on physics. This was a gross mistake that we will show in this report. As turned out, the true value of the average value of the circular current is twice as large, namely, to compensate, thus, the lost half of the moment at the calculations, the concept of spin of a relatively huge absolute value of, and corresponding to it, the spin magnetic moment were introduced eventually. The opinion has fully formed that the presence of an intrinsic mechanical moment, the spin, of an electron of magnitude, is a real fact. However, there are no direct evidences. Information on the determination of the spin magnetic moment on free electrons is absent

Biography

Georgi Shpenkov has completed his PhD in 1968 from Ioffe Physico-Technical Institute of RAS (Leningrad) and DrSc degree in 1991 (Tomsk, RAS). He is Retired Professor, Honorary Member of the Russian Physical Society. He has published 9 books and more than 100 papers in different issues. His main achievements include a series of key discoveries, in particular: the origin of mass; the nature of electric and gravitational charges; the Shell-Nodal (molecule-like) structure of atoms, the microwave background radiation of hydrogen atoms; the Fundamental Period-Quantum of the Decimal Code of the Universe, the Fundamental Frequencies of the atomic, subatomic and gravitational levels, and etc.

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SYNTHESIS OF SINGLE CRYSTAL MAGNETITE NANOPARTICLES ENCAPSULATED IN APOFERRITIN

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To get homogeneous nanoparticles (NPs), the protein (apoferritin) cavity has been utilized as a reaction chamber. A protein shell served as a template to restrain particle growth and as a coating to prevent coagulation between NPs. Apoferritin is an iron storage protein found in many biological species, known to mineralize several metal ions *in vitro*. It is a hollow, spherical protein composed of 24 subunits (L-chain and H-chain), with outer and inner diameters of 13 nm and 7.4 nm, respectively. Here, we report synthesis of magnetite crystal (Fe3O4) nanoparticle in the apoferritin cavity. Magnetite containing apoferritin is known as magnetoferritin, and its magnetic properties and applications were reported many times. However, crystallinity of these nanoparticles was not exactly controlled. Native horse spleen ferritin (contains about 15% of H-chain) or recombinant human H-ferritin was used for these experiments. H-chain has Fe (II) oxidation site and thus oxidation occurs very quickly at each oxidation site in the cavity. In this reason, synthesized nanoparticles were amorphous or polycrystalline. We have used recombinant L-chain apoferritin which lacked Fe (II) oxidation site and oxidation proceeds slowly. Utilizing slow oxidation process and magnetic-column chromatography purification process, we succeeded to obtain magnetite NPs with nearly single crystal domain which expected to have high T_2 relaxivity in MRI and high efficiency for hyperthermia therapy. We extended the N-terminus of the apoferritin subunits, which exposed to the external surface of the molecule, with peptide chain having specific binding ability to the cancer cell. Combining high quality magnetite nanoparticles and cancer cell specific apoferritin, this magnetoferritin would show high potential for cancer treatment

Biography

Hideyuki Yoshimura has completed his PhD in 1982 from Nagoya University and Postdoctoral studies in Institute of Physical and Chemical Research (RIKEN). He moved to Biometrology Lab in JEOL Ltd., as a Research staff in 1984. He was also joining JRDC, ERATO NAGAYAMA Protein Array Project from 1990 to 1995, as a Manager of Array Characterization Group. After 1995, he moved to Meiji University, Department of Physics, as an Associate Professor. He was promoted to Professor in 2000 at the same department. His current interests are development of an X-ray microscope for biology and synthesis of nanoparticles utilizing protein function.

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THERMAL PROCESSING OF RAW MATERIALS BY THE EXTENDED DISCRETE ELEMENT METHOD (XDEM)

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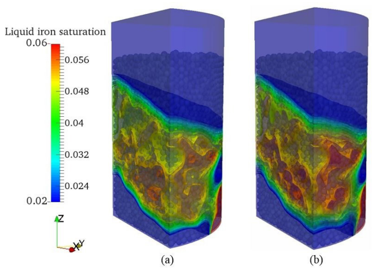
Thermal processing remains the most important method to process materials of any kind in particular raw materials such as iron ore or hard metal powders and the scale of the industry is enormous. Owing to the large scale, manufacturing industries are obliged to design and perform their production both perfectly and optimized under sustainable constraints. In general, processes for thermal treatment are complex and most likely involve various aspects of thermodynamics, fluid dynamics, chemistry and physics that are tightly coupled in space and time. In order to unveil the underlying physics, the innovative approach extended discrete element method (XDEM) was developed and is applied to the iron making in a blast furnace as shown in fig 1 and the reduction of tungsten oxide. The solid phase consisting of particles is treated in a Lagrangian framework so that the thermodynamic state of each individual particle is determined. The flow within the void space between the particles is described by advanced computational fluid dynamics (CFD) that estimates temperature, velocity and composition of the gas phase. Both, gas and solid phase are coupled through an intensive exchange of mass and heat. Both applications, reduction of iron ore and tungsten oxide revealed a very good agreement between experimental data and predictions. Non-uniform flow distributions led to reduced reduction performance due to insufficient amounts of the reducing agent. Hence, the presented numerical XDEM platform serves as an excellent tool to identify deficiencies for design and operation



Biography

Bernhard Peters has completed his Graduation in Mechanical Engineering (Diplom-Ingenieur) and PhD in Behavior of a 3-way catalyst during transient engine operation. From Technical University of Aachen. He is currently the Head of the Thermo-/ Fluid dynamics section at the University of Luxembourg and an Academic Visitor of the Lithuanian Energy Institute (LEI). After completing his Post-doctoral Research at Imperial College of Science, Technology and Medicine, University of London, UK, he established a research team dedicated to thermal conversion of solid fuels at the Karlsruhe Institute of Technology (KIT) and worked hereafter in industry at AVL List GmbH, Austria. His research activities at the University of Luxembourg include thermo/fluid dynamics in particular multiphase flow, reaction engineering, numerical modeling, High performance computing (HPC) and all aspects of particulate materials such as motion and conversion for which he developed the extended discrete element method (XDEM).

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ENERGY DENSITY OF ELECTROMAGNETIC WAVES AND ITS EXTENSION TO ALL ATOMS OF PERIODIC CLASSIFICATION

Franck Delplace
ESI Group Scientific Committee, France

By introducing the concept of fluid, or more accurately, of liquid space-time, nearly ten years ago, Delplace proposed to modify classical quanta equations in order to introduce energy density. In both Planck and Einstein equations for electromagnetic waves, energy was divided by a volume representative of atomic particles scale giving an energy density. This change in quanta equations gave a strong analogy with classical fluid mechanics equations and Planck's law took the same form as a rheological equation of state (stress tensor proportional to rate of strain tensor, proportionality constant being the liquid dynamic viscosity). This result justified introduction of fluid space-time and analogy allowed to consider the ratio of Planck constant to a volume as a dynamic viscosity value (dimensions are the same). The problem was then to define a reference length or scale length representative of phenomena at atomic level. By considering that, energy densities should be identical at both atomic and astronomic (general relativity) scales, Delplace found a reference value of 1 fm. Using a sphere volume of radius 1 fm, allowed electromagnetic stress was produced by electromagnetic waves to be calculated as a function of wave-length. Finally, the approach was applied to all atoms of periodic classification. Huge densities found for atomic material i.e. electron, proton and neutron gave a very high value of stress produced by each atom in fluid space-time. Using a fluid mechanics mixing model, we proposed to characterize atoms by a parameter which depends on atoms orbitales shapes and complexity. This model could be useful for nanotechnologies applications by giving a new way to characterize atoms behaviour and physical properties

Biography

Franck Delplace has obtained his PhD in Mechanics at Nancy University (France) in 1994 and he started his career as Researcher in Fluid Mechanics and Thermal Sciences at INRA. After Honorary Research Fellowship at Birmingham (GB) University, he was included in the American Who's Who in Science and Engineering (1998). He occupied Technical Expert Position in several companies until today at EDF (French Major Electricity Co). In 2011, he reached the Scientific Committee of ESI Group (Leading French Co in Numerical Simulation) as an expert in Fluid Mechanics and Industrial Challenges. His research interests are in both Physics and Mathematics: Fluid Mechanics, Gravity Theory, Field Theories including Quantum Gravity, Riemannian Manifolds and Complex Functions (Euler-Riemann zeta function). He published more than 50 papers in reputed journal and he is a Co-author of publications with famous mathematician H Srivastava. He is also Editorial Board Member of many scientific journals and Chief Editor.

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VARIABLE MAGNETISM OF COBALT-FULLERENE MIXED SYSTEM

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Great activity in spintronics-related fields in recent few years revealed importance in combining magnetic metal nanoparticles and organic semiconductor that promises new nanomaterials with attractive magnetic and electronic properties. Here, we demonstrate the remarkable nanocomposites, formed through self-assembling in the cobalt-fullerene mixture, which exhibit tunable magnetism. The CoxC60 films (x<120) were fabricated by simultaneous deposition of Co and C60 onto the same substrate under controlled conditions. We found that magnetic properties of the films strongly depends on the Co concentration x. The Co_xC_{60} films with x<2 demonstrate a ferromagnetic behaviour. At higher x (x>2), the films become superparamagnetic. Such a magnetic transformation correlates with the changes in the film nanostructure. In the interval of x<2, the film nanostructure consists of the bulk fcc-C_{60} and Co_2C_{60} phases only. At higher x (x>2), the Co clustering occurs, and the film is a nanocomposite (NC) as the arrays of small Co clusters (few nm in size) distributed in the C_{60}-based matrix. Parameters of the NC (size and fraction of the Co clusters) designate the features of the superparamagnetic effect (coercive field, saturation magnetization, blocking temperature T_b). Remarkable changes in the film magnetism occur upon the air exposure of the $CoxC_{60}$ films. In particular, magnetization of such films revealed vertical shift of the hysteresis loops suggesting the effect of interface exchange magnetism. In the interval of x>30, the oxygen content in such films is dropped down as well as Tb is increasing that reflects coalescence of the Co clusters. The CoxC60 films with x>40 show ferromagnetic behaviour at room temperature that allowed us to detect their magnetic domains using magnetic force microscopy. The discovered magnetism of the Co_xC_{60} films designates their potential for application in high-dense magnetic memory, sensors and catalysis

Biography

Vasily Lavrentiev has completed his PhD in 1984 from Leningrad Polytechnic Institute (St. Petersburg, Russia). He received Postdoctoral experience in Institute of Applied Physics (Sumy) and Institute of Physics at Augsburg University (Augsburg). His activity in nanoscience has been started from 2000 in Japan Atomic Energy Research Institute (Takasaki). Presently, he is a Researcher of Nuclear Physics Institute CAS. He has published more than 140 papers in reputed journals.

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FORMATIVE BIOFABRICATION USING MAGNETIC LEVITATION

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Several research groups in USA, Turkey and Russia recently demonstrated the principal feasibility of magnetic levitational bioassembly of tissue engineered constructs from living tissue spheroids in the presence of paramagnetic medium. However, employed paramagnetic medium containing Gadolinium is relatively toxic at concentration enabling magnetic levitation. Using high magnetic field at the European high field magnet laboratory (HFML) at Nijmegen, The Netherland, it was possible first time to perform magnetic levitational assembly of tissue constructs from tissue spheroids biofabricated from osteosarcoma cells at 100 times lower concentration of Gadolinium. High magnetic field in this situation works as a temporal and removal support or scaffield. The magnetic levitation can serve as a Earth based model of space microgravity. Thus, formative biofabrication of tissue engineered constructs from tissue spheroids in the high magnetic field is a promising research direction

Biography

Vladimir Mironov has completed his MD from The Ivanovo State Medical Institute in 1977, PhD in 1980 from The Moscow Pirogov State Medical Institute and Post-doctoral studies from The Max Planck Institute for Psychiatry in Martinsried, Germany and from Medical University of South Carolina, Charleston, USA. He was a Director of the first Advanced Tissue Biofabrication Center in USA. He is now a Chief Scientific Officer of company 3D Bioprinting Solutions. He is a world recognized pioneer of organ printing technology. His company developed a first Russian commercial 3D bioprinter Fabion and then bioprinted a world first functional and vascularized organ – mouse thyroid gland construct.

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